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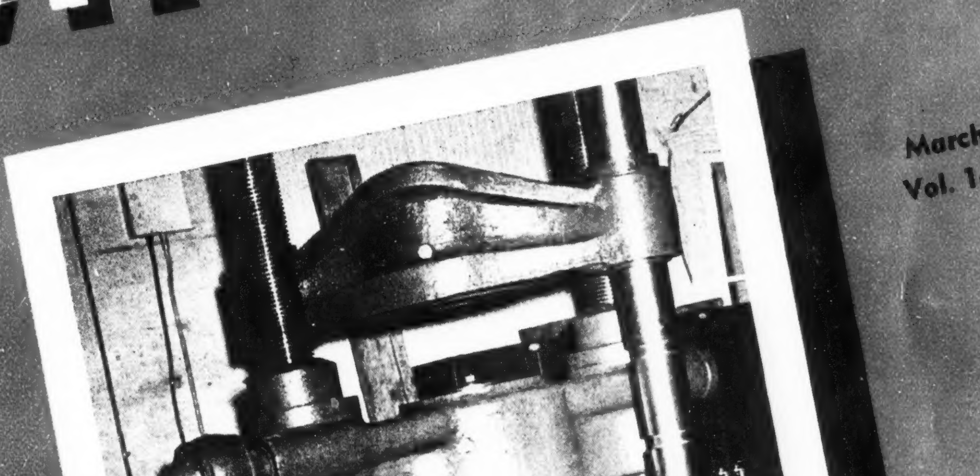

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COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

Thousands of Acres of Southern Farm Land Revitalized

Tennessee Coal, Iron and Railroad Company

plays important role in task

FOR years, the devastating "one-crop system" robbed vast acreages of southern soil of the vital mineral elements which support plant growth. Cotton or tobacco raised in the same fields year after year had reduced the fertility of many southern farms to the point where the annual yield hardly paid for the seed and labor that went into production.

Among the things that agricultural leaders found in their efforts to build up southern agriculture was that Basic Slag—a by-product of open hearth steel, as manufactured at the Ensley (Alabama) Works of the Tennessee Coal, Iron and Railroad Company, a subsidiary of United States Steel Corporation – contained several important minerals, including phosphorus and lime. These elements are needed to grow bountiful crops and high beef and milk producing pastures.

Today, Basic Slag is in wide use as a convenient, economical soil builder. Together with the other soil-building programs of the agricultural agencies, it has helped the southern farmer to prosper.

Opportunities . . .

Here is another example of the important work being done by the United States Steel family. If you would like to take part in the widely-varied projects being conducted, why not see your Placement Officer for a copy of the book "Paths of Opportunity in U.S. Steel"?

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CONTENTS

Cover: Testing machine for light gage steel members.

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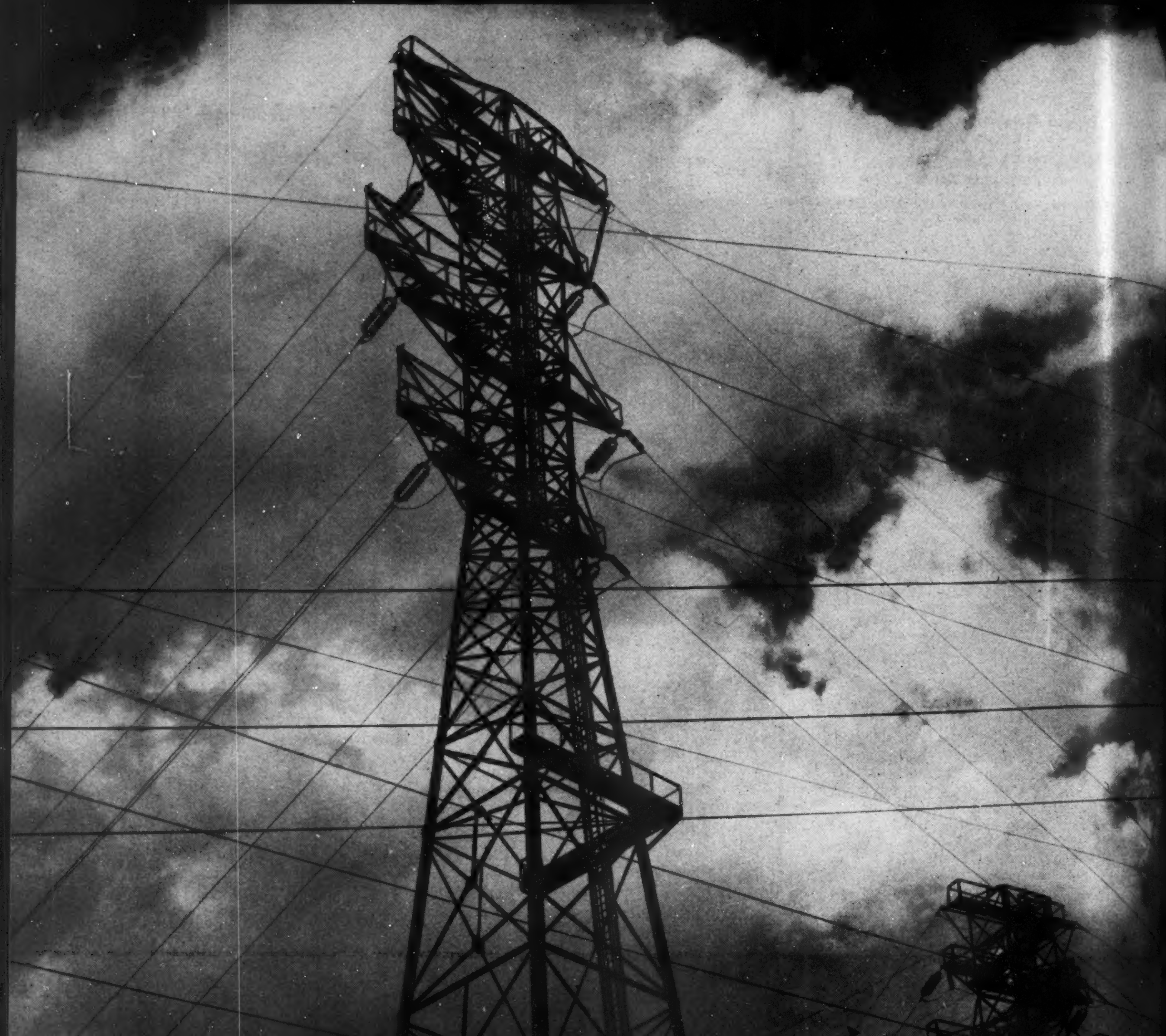


Light Gage Steel--A New Technique in Building Construction

By PROFESSOR GEORGE WINTER

STEEL contruction is not a new art. There is evidence that the Greeks joined their marble blocks with metal dowels to insure greater strength. The great gothic cathedrals of the 15th and 16th centuries with their astonishingly light and daring vaults, arches, counterforts and steeples could not have been built but for the use of iron ties, anchors and dowels embedded in the masonry blocks. The great dome of St. Paul's Cathedral in London (around 1700 A.D.) depends for its stability on heavy, wrought iron chains wound in a ring around its base and encased in concrete. Part timber, part iron bridges were built in this country in the first half of the 19th century.

Development of Steel

What we know as steel construction today, however, had to await two further developments, without which not only this field of engineering but our entire industrial civilization would be unthinkable: an inexpensive and efficient way of shaping metals in mass production (the rolling mill, invented by Cort in 1783), and an inexpensive and efficient way of mass producing steel (Bessemer, 1855, and Siemens, 1861).In consequence, the second half of the 19th century saw the development of steel structures as we know them today, the bridges and mill buildings, the skyscrapers, towers, tanks, bunkers, mine heads and dozens of other types in which the steel carries the load.

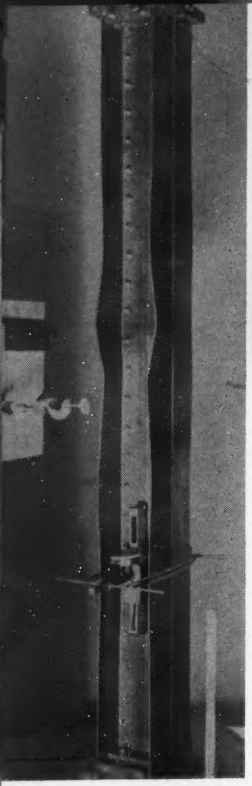
All these various steel constructions have one feature in common. They are all major structures, rather large in size, carrying heavy loads. Steel was little used in the millions upon millions of smaller structures that dot the land, the private dwellings, the smaller commercial establishment, the filling stations, the repair shops, the agricultural structures. Steel could not be used economically for such light and moderate size structures in view of one serious limitation—structural steel shapes, such as channels, I-beams, angles and the like, cannot be rolled by ordinary methods with thicknesses smaller than about 3/16 in., and generally are rolled not under 1/4 in. thick. This is no detriment where heavy loads have to be carried and long spans covered, requiring large and massive sections to provide the necessary strength. However, for the moderate structures just enumerated, standard rolled shapes would be many times heavier and stronger than required to carry the small loads and bridge

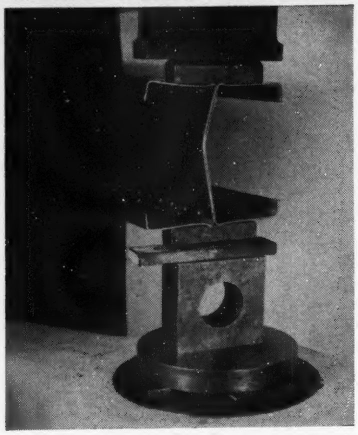
THE AUTHOR

A native of Vienna, Austria, Professor George Winter received his M.E. degree from Munich Institute of Technology in 1930. From then until 1938 he was active chiefly in the structural design of large industrial plants. He spent six of these eight years as a foreign consultant in Russia. Coming to Cornell in a research position in 1938, he received his Ph.D. here in 1940 and, going through the usual stages of academic promotion, was appointed full professor and head of the department of structural engineering in 1948. He is the author of numerous research papers in the field of structural engineering and is active on many technical and research committees of the A.S.C.E., the Column Research Council, and other organizations.

George Winter

Power at a potential of from 66,000 to 22,000 volts is transmitted by these high-voltage lines.
—Courtesy Westinghouse





Light gage steel specimens under test, showing typical behavior which usually are not met with in standard, heavy steel construction. *Left*: a light gage stud under compression load; flanges are buckling. *Top*: part of a light gage beam; flanges are buckling. *Right*: end section of a light gage beam under local compression; web is buckling. By producing these behaviors in the laboratory, design rules are developed to prevent such occurrences in practice.

the small spans, and hence could not compete economically with other materials better adapted to such uses. It is for this reason that most of us, in this industrial age, still live in handmade wooden buildings of a type that has not changed, fundamentally, for centuries.

Limitations of Wood

But timber is becoming scarce in this country and in many others; it is inflammable, subject to rot and attack by termites; it warps and deteriorates as moisture and temperature change during the cycle of the seasons; and the carpenter's time-honored way of cutting and fitting and nailing each piece laboriously by hand has raised the prices to such a degree that residential and moderate commercial construction is way behind the general growth and the rise of living standards of the nation. Here was a field that was waiting to be entered by the steel industry with its mass production methods. But to do that in a competitive market a way had first to be found to produce inexpensive, thin, light structural shapes that would adapt themselves to small loads and short spans and that could be produced in quantities and at prices competitive with timber, brick and other established materials.

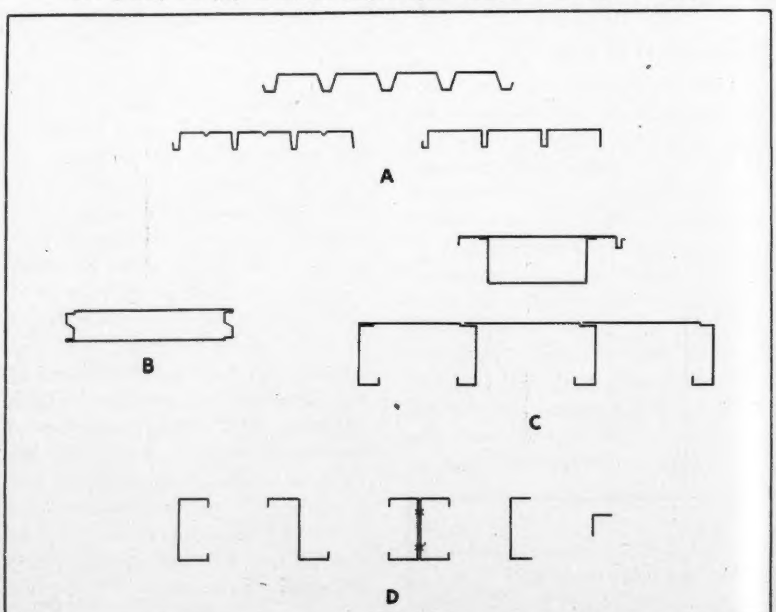
Structural members of this type, if they were developed, would not be limited to moderate size buildings. Even in large structures, where the main framing is heavily loaded and consists of standard rolled steel shapes, there are substantial portions that fall under the category of light loads and small spans. Such portions are roofs, floors, and partitions. The latter two, in many cases, are still built by hand with brick or other inefficiently small units. As regards floors, though reinforced concrete has represented a satisfactory material for decades, the large number of pipes, electric conduits, radiant heating units, that are laid in the floors of modern buildings are increasingly difficult to place in concrete floors. A cellular construction which would provide open, accessible spaces for such equipment, would serve many purposes much better than existing floor constructions.

New Technique

Thus in one of the oldest industries, that of building construction, there was a need for an entirely new type of technique which, if developed, would have an almost unlimited range of usefulness.

The way to provide this new technique was found by a combination of three elements: steel sheet, the press brake, and electric welding. In contrast to structural shapes, steel sheet can be rolled as thin as desired, down to 5/1000 in. and less, although for structural use sheets thinner than 3/100 in. are

Fig. 1. Types of light structural steel elements. (A) roof decks, (B) wall panel, (C) floor panel, and (D) structural shapes. Spot welds are indicated by crosses.



Light gage steel panels, set vertically, form wall of nylon plant in Tennessee. Hollow space of these box-shaped panels is used for insulation, such as rock wool.
—Structure photos courtesy Detroit Steel Products Co.

rarely used. Sheet by itself, of course, is too flexible to carry any significant loads. This drawback was overcome rather early by the development of corrugated sheet, as it has been used for roofing for many decades. However, the peculiar shape of this product restricts its application severely. It cannot be used for floors, or for walls except for shed-type structures, and even for roofs and light walls its wavy surface makes it unsightly and difficult to insulate. With the development of the press brake a tool was found which could bend sheet steel into practically any conceivable shape, which could form any angle or most any desired radius. Electric welding, finally, and spot welding in particular, made it possible to join any number of such elements, either in mass production in the factory, or on erection joints on the site.

Professor George Winter was the first recipient, in January, 1949, of the newly established Leon S. Moissieff Award of the American Society of Civil Engineers for his paper "Strength of Thin Compression Flanges." The paper is of a series of publications by Professor Winter and his collaborators on the results of their researches on light gage steel structures.

Problems Solved

It was now possible to produce light structural elements of a great variety of types, specifically adapted to their use. A very few of these forms are shown in Fig. 1. Some are of much the same kind as ordinary rolled shapes but much thinner; others, such as roof decks, floor and wall panels are new and peculiar to sheet steel construction.

But producing such elements was one thing, introducing them and having them accepted was quite another. Old rules of design did not apply to these new members; building codes made no provisions for them; and building officials, local, state, and federal, refused to approve them unless sound design information and practice was established.

It was at this point that Cornell University was approached by the American Iron and Steel Institute with the request to establish a cooperative research project. The purpose of this undertaking was to develop scientifically sound design procedures for light gage steel construction. It was to furnish the fundamental engineering information on the basis of which eventually a set of design specifications could be developed which would be generally accepted as sound by the profession, and which would take their place alongside such long established design codes as have governed and facilitated for decades the use of reinforced concrete, rolled steel, and other techniques in building construction. This research has been carried out under the writer's direction at the School of Civil Engineering ever since, and although the first Specification for the Design of Light Gage Structural Members was issued by the Steel Institute in April 1946 and is by now accepted widely throughout the land, new problems and new uses have required continued investigation.

Thinness Presents Problems

This is not the place to discuss in detail the peculiar problems and intricacies encountered in investigating the strength and behavior of light gage structural members. In general, it is the very thinness of the material which creates peculiar effects and make inapplicable established design procedures. Under load such members, if incorrectly designed, may warp, twist, and buckle in ways not met with in ordinary structures. To explore such behavior fully and to devise safe methods of design for structures of this type it was not only necessary to carry out intricate tests on about a thousand specimens of widely varying types. In addition, the more advanced mathematical theories of elasticity and stability had to be called upon, and new theories devised where necessary. A design procedure, in general, is sound only if it is based on rigorous fundamental theory which, in turn, must be extensively confirmed by test. It was this ap-

(Continued on page 26)

Light gage steel roof deck, 0.036 in. thick, covering the plant of the Eddy Paper Co., Detroit, Michigan.

INDUSTRIAL HAZARDS
MEAN MAN-HOURS LOST

The Engineer Seeks Accident Control

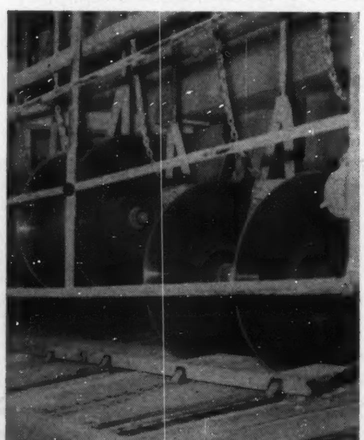
By A. CHURCHILL BLACKMAN, M.E. '29

FLASH — Entire student population of Cornell University wiped out in occupational accidents!

A good article should start out with a punch line to attract and hold the readers' interest. Although you may feel that this opening sentence is dramatic, it is actually true that some 17,000 persons were killed in occupational accidents in 1947. Thus, almost twice the number of persons are killed at work annually as there are students in Cornell.

It is most important, in my opinion, that all engineers, particularly those of you who are about to graduate or have recently graduated, realize the responsibility that rests on you as a group for the saving and preservation of lives. Because the problem of controlling accidents and their resulting injuries reaches into every phase of human activity, it would be impossible to discuss it adequately in this one article. Let us confine our thoughts, therefore, to a few of the fundamentals concerning occupational accidents.

One of the most hazardous pieces of machinery—the gang saw. Though mechanically fed, protection has been secured by the addition of a barrier.
—Courtesy West Coast Lumbermen's Ass'n.



Fundamentally, the profession of engineering originated out of the necessity of making machines work and do things for men, and to make this world a better and more efficient place in which to live and work. By virtue of the engineer's knowledge of materials and processes he is able to supply a scientific solution to present day problems and bring forth a new and finer idea, build a better bridge or devise a more seductive mouse trap. Thus, through scientific engineering is our present day civilization built.

Safety Measures Progress

The progress of civilization should not be measured, however, on the things it originates for evil, but rather on those it develops for good. Is it not true that our Western civilization is based on the philosophy and religious belief that human life and liberty are our most valuable possessions? If so, then the measure of science and engineering is its ability to make life safer as well as more productive. The two must run concurrently, and the engineer is charged with that responsibility. He must not lose sight of the safety factor in his enthusiasm for greater production.

What Is Safety?

This naturally demands a definition for *safe, safety,* and the phrase *make it safe.* Funk and Wagnall's College Dictionary defines safe as "free from danger; not hazardous, not involving risk." These are hardly measurable terms like height and breadth, weight and volume, or specific gravity and density, but rather intangible and mutable, though a very essential quality. That which may prove safe for one man may be unsafe for another. A stairway or building, or a process can be safe under one condition and hazardous under another. A well trained physicist can safely handle radioactive isotopes, whereas the most competent civil engineer might handle them only at considerable risk to himself, as well as others in the immediate vicinity. Thus, good safety engineering is the development of safeguards for present and future hazards in the light of past experience.

Obviously, the test of whether a piece of equipment or a process is safe depends upon who is to use it. The machine and the raw materials

The punch press, a machine that has caused much needless human mutilation in industry. Practical methods of enclosing the dies in a punch press have been found; such technical problems are those of the engineer.
—Courtesy Norris Stamping & Mfg. Co.

are all tangible quantities but the human factor is an unknown variable. The law has attempted to define this human factor by the legal term of "a reasonably prudent, normally capable person." Thus, it can be said that this person is the one who will probably use the equipment, and therefore will be the one to be exposed to its hazards.

Responsibility of Engineer

Thus it becomes apparent that an engineer has not discharged his ultimate responsibility of creating the machine in such a manner that it is safe for the legally normal or prudent person, since other men can circumvent these safeguards and actually do so with a great degree of regularity. For example, although our most modern automobiles are probably not perfectly designed from the point of view of safety to both the individuals using them and those who are exposed to their use, they can be used safely, as is proven by the records of many people who have used motor vehicles for many years without either injuring themselves or anyone else. On the other hand, great numbers of people are killed and injured regularly day in and day out because they do not use automobiles correctly. You know our state's rules and laws pertaining to the operation of motor vehicles, but how many times do you knowingly, yes even deliberately, violate them? Have you ever asked yourself *why?*

Let us take the example of the man who places a box upon a chair to reach a high object, when he knows it is unsteady, rather than get a suitable ladder. He has the knowledge but lacks or fails to use good judgment. Needless injury and deaths are occurring every day in every state in every walk of life, due to man's willful disobedience to common sense rules or disobedience to the training that he has been given. As an example of this one type of injury, over 1400 persons suffered disabling occupational injuries last year in the State of California because of falls from ladders.

So the *safety engineer* steps into the picture and is engaged in trying to prevent man from shortening his own life or that of others. For the most part, the safety engineer in industry is directly concerned with those injuries which occur to people while at work. Because this involves a relationship of man with machine, he usually is and probably should be an engineer. By virtue of his engineering training, he understands the basic production problems, and because of his specialized training in accidents and their causes, he has also found that it is necessary to know a great deal about the other factor, probably the largest factor—man himself.

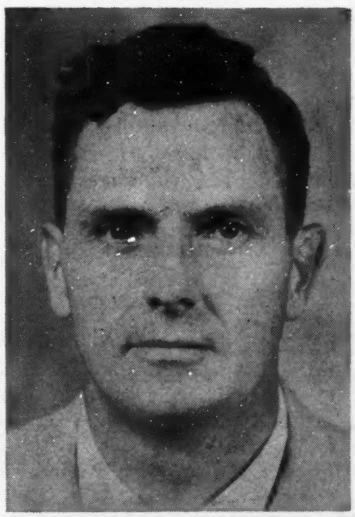
Over the years, government has gradually stepped into the field of establishing standards in an attempt to define what is safe in the matter of design of equipment, processes and buildings, because of the need

(*Concluded on page 30*)

THE AUTHOR

A. Churchill Blackman is Chief of the Division of Industrial Safety, Department of Industrial Relations, of the State of California. Appointed to this post by Governor Earl Warren, he is responsible for the administration and enforcement of accident prevention measures covering every industry in the State.

Mr. Blackman first entered the field of industrial safety as a safety engineer with the Liberty Mutual Insurance Company in 1931, after graduating from Cornell with a mechanical engineering degree in 1929. During World War II, he received a commission in the Medical Department and was assigned to the Army Industrial Hygiene Laboratory as an industrial hygienist. Mr. Blackman is a member of the American Society of Safety Engineers and the American Industrial Hygiene Association.



A. Churchill Blackman

Measuring Time With Atoms

Photographs courtesy National Bureau of Standards

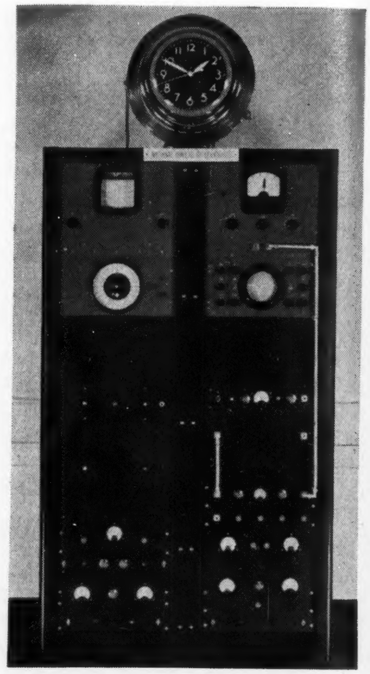
Usually when one asks "What time is it?" he means "What does your watch read?" and assumes that his friend's watch satisfies his needs for accuracy. In back of his mind is, however, the thought that somewhere it is possible to find exactly what time it is. The exact time is obtained from the position of the earth on its axis, and this method of measurement has so long been the most accurate one available that it has become almost synonymous with time.

Actually, the earth is a mechanism which suffers from many inaccuracies and inconsistencies, and the quality of physical measurements is now such that variations in the mean solar day are apparent. To remedy this fault, the National Bureau of Standards has developed and built an atomic clock, which uses as its measuring stick the vibrations of ammonia molecules. Thus we have a new standard of time and frequency measurement, more accurate than the earth itself, which will have important applications in astronomy, chemistry, and radio work.

Operation of the clock depends on the fact that an absorption frequency of ammonia has been found in the microwave region of the electromagnetic spectrum. Design of the clock, then, consisted of developing an entirely electronic set-up which would use this invariable absorption frequency to control an oscillator which would drive a clock. The oscillator is a 100-kilocycle quartz-crystal unit of high stability, and by means of vacuum-tube circuits and silicon crystal diodes, this frequency is multiplied up to that of the absorption line of ammonia occurring at 23,870.1 megacycles. This signal is impressed across the absorption cell, which is a 30-foot copper tube in a coil at the top of the clock, containing ammonia at a pressure of 10 or 15 microns of mercury. If the frequency of the multiplied oscillator output differs from that of the absorption line, absorption decreases and control circuits generate an "error signal" which tunes the microwave signal back to the absorption frequency.

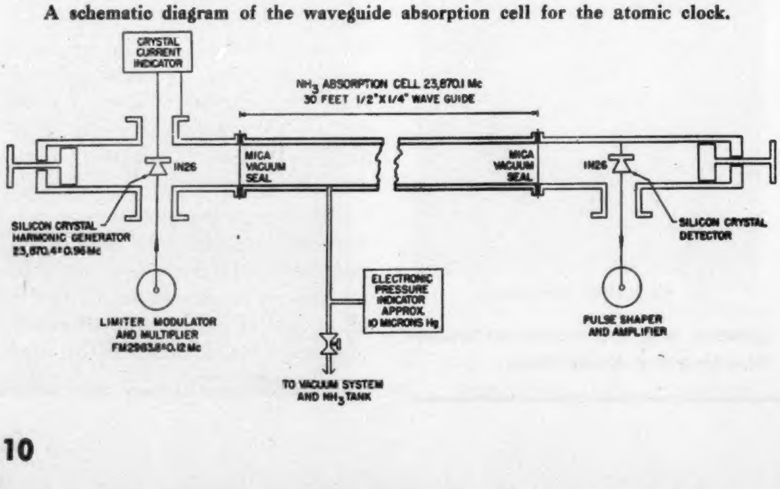
By this means the oscillator frequency is maintained very close to 100 kilocycles, and frequency dividers divide it down to 50 and 1000 cycles to drive two synchronous clocks; the 50-cycle unit is the common one seen on top of the equipment and the 1000-cycle clock is a special one designed for exact adjustment and comparison with astronomical time to within .005 second. Time constancy of the clock is of the order of one part in ten million, for the control circuit is very sensitive and the absorption frequency of the ammonia molecule is one of its most dependable properties.

The new clock will improve the accuracy of astronomical measurements by providing a check on the length of the mean solar day. As a measure of time it is also a very accurate measure of frequency, and it can be used for transmitting standard frequency signals for the maintenance of close tolerances on commercial and military high-frequency transmitters, reducing the necessity of allowing wide bands for drift.



Above is shown the National Bureau of Standards' atomic clock. Conspicuous at the top is a 50-cycle clock, with the copper absorption cell wound around it.

A schematic diagram of the waveguide absorption cell for the atomic clock.



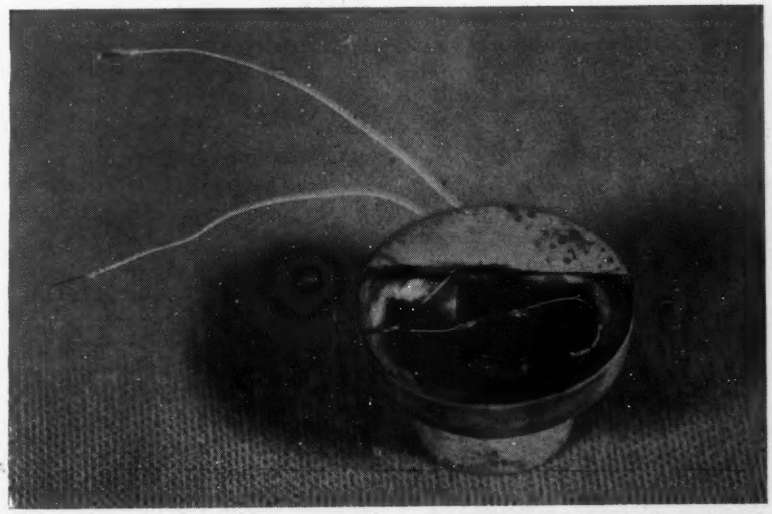
Research in Low Temperature Physics

LEONILDA ALTMAN, EP '51

JUST as the old alchemists' dream of turning baser metals into gold has been proven possible by the atomic researches of today, so another long-cherished concept, that of *perpetual motion,* has been found to exist in present-day investigations into the strange phenomena existing at temperatures near the absolute zero. That this perpetual motion should exist in what had always been considered a region of perfect stillness is another example of the resolution of apparent paradoxes by the objective methods of modern science.

Ever since the molecular theory of gases and the kinetic theory of heat were formulated as they are today, it has been recognized that temperature is a measure of the intensity of molecular motion, and, in general, the lower the temperature, the less the molecular motion. It was therefore reckoned that at absolute zero, atomic motion stopped, and a state of perfect rest was reached.

All of these hypotheses were upset around 1925 with the development of the newer theories of quantum mechanics associated with wave mechanics. It was conceded that motion did exist at the lowest (zero) energy level, the so-called zero point energy. It was also recognized that perfect order rather than perfect stillness was the significance of absolute zero. The thermodynamical concept of entropy is a measure of the amount of disorderliness in the distribution of energy or of the motion of atoms or



The superconducting bolometer, consisting of a small strip of colombium nitride cemented in such a way to a copper post that it has good thermal contact but is electrically insulated. The wires lead to an electronic amplifier.
—*Courtesy Refrigerating Engineering*

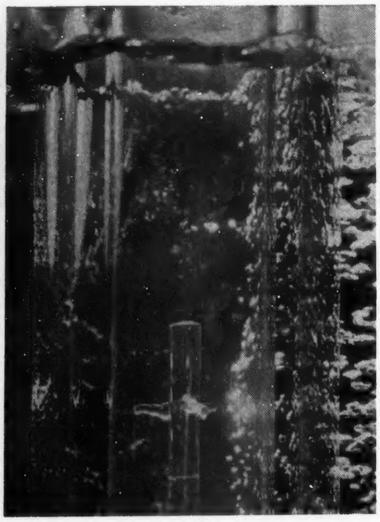
molecules. Therefore entropy is proportional to motion, which is in turn a function of "orderliness."

The low temperature desired by investigators were reached chiefly by liquefying gases. Before the end of the nineteenth century, every common gas except helium had been liquefied. Kamerlingh Omnes of Leyden finally accomplished this task in 1908 by reaching the critical temperature of helium,—268°C, only 5° above absolute zero.

Superconductivity

It was Omnes, who, in his extensive research in the field of low-temperature phenomena, discovered the property of superconductivity in metals. He found that at 4.12°K, mercury loses all electrical resistance. Using a torus-shaped piece of lead at 7.26°K, he started a flow of electrons by means of a magnetic field. He found that, once started, these electrons continued to flow with no apparent diminution of motion, thus constituting a perpetual motion of electrons! The specific resistance of lead in this superconducting state was found to be less than 10^{-20} ohm-centimeters, and it was concluded to be really zero.

Further investigation revealed that, although it may rise, resistance in general decreases directly and rather uniformly with temperature until a certain point where it drops off very sharply. For instance, the resistance of tin drops slowly



At left *superfluid* helium is dripping from a small container after creeping up the walls and over the sides of the container. The "fountain effect" is shown on the right, where a glass tube is connected through a very narrow capillary to a helium bath. Heating the liquid in the tube leads to a rise in its level.

—*Courtesy Arthur D. Little, Inc.*

until 3.7°K is reached; at this critical point it drops so sharply that 50 percent of the resistance is lost in an interval of less than 10^{-4} degrees. The sharpness of this change depends upon the purity and the crystallinity of the metal, and its transition is correspondingly sharper as the metal approaches the state of a single crystal. Irregularity of shape may also widen the transition range.

Meissner Effect

Perhaps more basic to the phenomena of superconductivity is the so-called Meissner effect: a superconducting metal cannot be penetrated by lines of magnetic force. This exhibition of perfect diamagnetism (zero magnetic induction) makes it an ideal magnetic shield. Not only does a magnetic field fail to penetrate, but a field already in the metal is expelled when the superconducting temperature is reached. Also, at some critical value, a magnetic field applied parallel to a superconducting wire will restore the resistance. The lower the temperature, the greater the critical value of the field. The transition point, that temperature at which superconductivity appears, is lowered roughly in proportion to the strength of the applied external magnetic field.

There seems to be no relation between superconductivity and other phenomena of metals. The photoelectric effect still occurs, absorption of beta particles or slow electrons remains unaltered, as does the reflectivity of metal for visible light or long infra-red radiation. (This latter property is closely related to electric conductivity.) Furthermore, superconducting metals exhibit no thermal electric effects, and the coefficient of thermal expansion is continuous at the superconducting transition point. Finally, the X-ray photographs are unchanged.

The explanation for this is that superconductivity involves relatively few electrons, and its effect on these make the rest unimportant by comparison. As the temperature goes below the superconducting point, more and more electrons become involved until the whole metal structure is affected.

So far, only eighteen superconducting pure metals have been found, and forty or fifty alloys. For practical applications, it is important to find alloys with ever higher transition points. The group with the highest such point is the interstitial group, compounded of metals and nonmetallic substances. The highest so far is colombium nitride, with a transition point of 14 or 15°K. More recently, the discovery of an anomalous magnetic effect in solutions of sodium dissolved in liquid ammonia has led to the hope that superconductivity may be found to exist in such solutions at temperatures as high as 100°K.

Resistance Thermometer

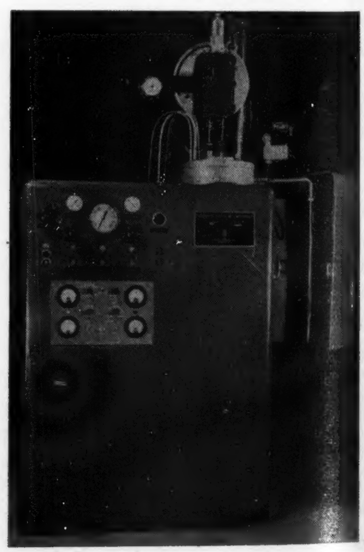
The compound colombium nitride has already found practical use in the construction of a resistance thermometer known as the *bolometer*. It gives temperature measurements much more sensitive and 100 times more speedy than have any previously known instruments. The strip of columbium nitride is held at the superconducting temperature by means of a cryostat, a small refrigerated can, which, when filled with 1000 cubic centimeters of liquid hydrogen, remains at 14°K for 15 to 20 hours.

Work with bolometers of this type led in December of 1946 to the interesting discovery that the bolometer is a good receiver of radio signals! In fact, at present, the bolometer is superior to any type of radio receiver in signal to noise ratio. Among other observations, the amount of radio reception was seen to vary with the temperature of the bolometer, very sharp changes

(*Continued on page* 40)

Liquefier and control panel of the Collins Helium Cryostat. The Cryostat contains an experimental space which can be held at any low temperature down to 2°K.

—*Courtesy Arthur D. Little, Inc.*



News of the College

New M.E. Courses

The Materials Processing Department of the Sibley School of Mechancial Engineering is at present developing a comprehensive curriculum of instruction in the various phases of materials processing. Courses are presently being given in the fundamentals of machine shop and allied operations. Also recently initiated is a course in production machine tools. These courses, however, are only the transient stages of what will eventually become a three course program covering cutting tools, machine tools, and planning machine shop operations. Until this curriculum can be completely developed, Professor Henriksen is offering an elective course in the Spring and Summer term in Advanced Materials Processing, covering the theory of cutting tool techniques and investigations of various types of machine tools and machine tool drives.

The new production machine tools shop overlooking Beebe Lake has made much progress in the development of facilities for instruction in production techniques, and will undoubtedly be instrumental in conveying to the students what is actually involved in the complex phases of modern production technique. Wiring has been completed and the machines are ready for operation. Professor Henriksen contemplates that these machines will be tooled up with appropriate jigs and fixtures, and with the cooperation of local industrial concerns, the machine tools laboratory will actually perform production operations for the use of the cooperating firms.

Heat Power Expert

Pio F. Martinuzzi, Italian expert on Automotive, Gas Turbine, and Aircraft Engine design, becomes professor of Mechanical Engineering this semester in the Heat Power Department of the Sibley School of Mechanical Engineering. Born in Germany and a citizen of Italy, Professor Martinuzzi received the BS at the University of Padua in 1920 and the PhD at the Turin School of Engineering in 1923. He has worked with companies in several continental nations. During the war, while acting as a consultant for a Swiss firm he lectured at a University set up for Italian internees, in Laussane. A post war lecture series brought him to eight cities in the United States under the sponsorship of the American Society of Mechanical Engineers. Recently, he has been head of the gas turbine section of the Italian National Research Council, and consultant to the Italian Navy, and turbine producing firms.

It is expected that in addition to teaching undergraduate Heat Power courses, Professor Martinuzzi will spend a considerable amount of time in research work along these same lines.

DuPont Grants $10,000

The Du Pont Company has announced that it is instituting a program of grants-in-aid to ten universities for the 1949-50 academic year for unrestricted use in the field of fundamental chemical research. The program, which at the start will be on a trial basis, has the aim of raising the amount of such research being done in this country above present levels, with a view to "stock-piling basic knowledge."

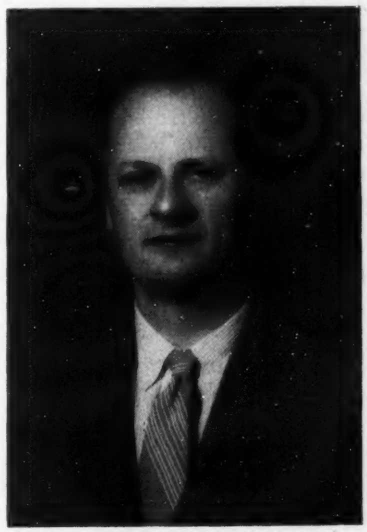
In addition to Cornell, grants-in-aid of $10,000 each are being offered to California Institute of Technology, Harvard University, Massachusetts Institute of Technology, Ohio State University, Princeton University, Yale University, University of Illinois, University of Minnesota, and University of Wisconsin.

The grants are being awarded for the academic year of 1949-50, but it is the company's hope, should the program work out satisfactorily, to continue each of them for a period of five years. The universities themselves will select the research projects in which the grants will be employed, the only stipulation being that they be free from any commercial implications at the time the work is initiated.

It was with these things in mind that Du Pont decided to inaugurate its program for grants-in-aid. The company hopes in this way to contribute something to make further progress in the stock-piling of basic knowledge.

Dr. Hans A. Bethe

Hans A. Bethe, professor of physics at Cornell University, is the author of the article on "Neutron" in the current revised printing of



Dr. Bethe

the Encyclopedia Britannica. Dr. Bethe, who received his Ph.D. from the University of Munich, came to the United States in 1935, when he joined the Cornell faculty. He played an important part in the atomic bomb project as director of the theoretical physics of division of the Los Alamos project. He is a member of the National Academy of Science, the American Physics Society, the New York Academy of Science, and the American Astronomical Society.

The Editor's COLUMN

Change In Responsibility

With this issue, a new publication board assumes its positions. A most capable staff has been lost through graduation; their reponsibilities are now ours.

Stated simply, these responsibilities are to publish a magazine once a month, this magazine to be called the CORNELL ENGINEER. In theory, this sounds elementary, but the actual analysis reveals numerous complications. The usual editorial problems are encountered—there is copy to be composed and proof-read, and impossible deadlines to be met. Add to this routine work the difficulty presented by having three different groups of readers: alumni, undergraduates, and high school students. Providing worthy editorial material to groups with such diversified interests is not an easy task.

All of this, needless to say, does cause us to increase our consumption of aspirin. But when out of the confusion a new issue of the magazine emerges, we see that our effort has not been wasted. The past year of publication was a very successful one, and we have much to which we can look forward.

New Program

The staff of the ENGINEER long has realized that contributions to the magazine from the engineering undergraduates have been few. We have come to depend on our editorial board for feature articles and have lately wondered if the students knew that they could have articles of their own published in the magazine.

The ENGINEER is the official organ of the engineering school; it belongs to those of the engineering campus. In order that it might better achieve its purpose, the student body should take a direct part in the formation of its editorial matter. We intend to further acquaint the engineers with this aim, and a detailed plan of our program will be announced soon.

PROMINENT

Billie

Billie P. Carter, ChemE

It seems impossible, in view of her versatility, to choose any one theme about which to weave a story about Billie Carter. If one gains any single impression, it is —"outstanding." Scholastic honors, extracurriculars, and responsible positions have been almost commonplace in her life at Cornell; and the breadth of her popularity matches the scope of her activities.

If this well-deserved build-up has not frightened the reader off, we might go on to support it with a few particulars. While attending Punahou High School in Honolulu, Hawaii—her hometown—Billie acquired an interest in the physical sciences, in part inspired by her father, an electrical engineer. Her choice of chemical engineering was derived from a conviction that she would feel more at home copying constants from a handbook than searching for synonyms in Roget's Thesaurus. Considerable success with the handbook resulted, at any rate, for she is about to become the second young lady to go forth from Cornell with the degree of Bachelor of Chemical Engineering.

The imposing list of honoraries to which she has been elected is sufficient evidence of unusual scholastic ability: Tau Beta Pi, Pros-Ops, Mortar Board, Pi Delta Epsilon, Pi Omicron, and Phi Kappa Phi; and the several offices which she holds or has held in them testify further to her capability and popularity among her fellow students.

The name, "Billie Carter," is scarcely strange to these pages, for she was no less than Editor-in-Chief of the CORNELL ENGINEER last year. Her activities have also included serving in the House of Representatives of the Women's Self Government Association; and her principle hobby, music, has found expression in participation as a cellist in the University Symphony Orchestra and as a member of the Willard Straight Music Committee.

Currently, she is well occupied with her senior research project.

(*Concluded on page* 34)

John W. Darley, EE

For Cornell theater-goers, the face of John Darley should be a familiar one. Beginning with "Fanny's First Play," John has appeared in the "Philadelphia Story," "Joan of Lorraine," and "Arsenic and Old Lace." His ability as an

John

ENGINEERS

actor may seem out of keeping with his electrical engineering curriculum, but John finds the diversion very welcome.

Hailing from Kenilworth, Illinois, John gradated from New Trier High School in February of 1943. He enlisted in the Army Air Forces and was sent to Kenyon College in Ohio for twelve months of pre-meteorology training. A year later, he was sent to Yale University for five months of intensive study in communications.

He received his commission upon leaving Yale and was sent to Florida for further study in electronics. Sub-search missions over the Atlantic in B-24's and B-17's followed. Transferred to California in March of '45, he was instrumental in setting up a radar observer-bombardment school.

(Concluded on page 34)

Richard L. Wanser, ME

It has been said that advertising pays. The truth of this axiom may be questioned, but it was the fundamental factor which influenced at least one student to come to Cornell.

Dick

Graduating from Glen Bard High School in his native Glen Ellyn, Illinois, in 1942, Dick Wanser applied for admission to Cornell. This was the direct result of the cogent advertising of the reputation of the Sibley School of Mechanical Engineering by several Cornell alumni, friends of his parents.

Beginning his first term in the fall of '42, Dick went out for Freshman football and basketball almost as a matter of course, since he was a three letter man in high school—participating in varsity football, basketball, and track. But his stay was brief; for those were troubled times and the Services needed men. Dick served in the Air Forces as an electronics officer; and, as a member of the 9th Air Force, was stationed in Germany, later serving with the Occupation Army.

He returned to Cornell and "hard work" in the fall of '46. A member of Sigma Phi fraternity, which he pledged in his first term, Dick also holds membership in Kappa Tau Chi, Pi Tau Sigma; Phi Kappa Phi; and Tau Beta Pi, of which he was recently elected secretary. Having been named thrice to the Dean's list, he is at present an instructor in basic accounting, and expects to receive his A.E.M.E. degree in June.

Thereafter, a job in production work or factory management would be to his liking, since he doesn't expect to continue teaching. A limiting factor in these plans is that the location be on the East Coast or near the Great Lakes; because Dick, himself a great sport enthusiast, is happily married and his wife likes sailing.

Richard J. Gilbert, CE

Attracted by the catalogue pictures of Triphammer Falls and the reputation of Cornell's hydraulics department, Dick Gilbert applied for admission to Cornell while a senior in high school in Brookline, Mass. He was graduated in 1943 and had been accepted at Cornell, but, conditions being what they

Dick

were, he decided to enlist in the army first. He spent two and one-half years in the army altogether, serving in the Combat Engineers Battalion of the 77th Division, in the Pacific Theater. When asked what rank he achieved, he reports that he was the ranking private of his outfit for many months. He ended up a T-5, however, and did some interesting work, judging from an article he wrote for the May, 1947, issue of the ENGINEER about road building in Okinawa. After the war ended he did some occupation duty in Japan, where he managed to get in some skiing.

Dick was discharged from the army just in time to start at Cornell in the spring term of '46, registered, of course, in the School of Civil Engineering. He is a member of Sigma Alpha Mu fraternity, and is now recorder of the chapter. He entered the fall, '46, competition of the CORNELL ENGINEER and was elected to membership in the editorial board; he was compet manager for the fall, '47, competition and in the spring of '48, became Illustrations Editor.

Dick hasn't yet decided what he'll do after he graduates, for graduate school or a job with a consulting engineering firm look equally enticing. Whatever he does will be connected with hydraulics, which he's been interested in since the age of 10. The ENGINEER wishes him success in his work.

Cornell Society of Engineers

107 EAST 48TH STREET   1948-1949   NEW YORK 17, N. Y.

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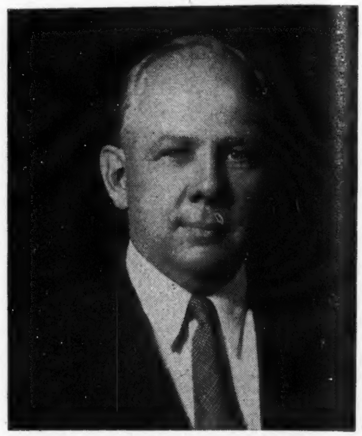


Creed W. Fulton, M.E. '09

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

On January 14th it was my pleasure to spend the day with the "Boys" in Ithaca.

I say "Boys" purposely, for everyone from Dean Hollister and his directors of the various Engineering Schools, to the last of some three hundred Engineering Seniors whom I had the pleasure of addressing, seemed imbued with a wonderful spirit of youthful enthusiasm.

My job that day was to convince the seniors that our society is an organization worthy of their respect and support. I hope I succeeded.

Our immediate concern is to correct the conditions, which in the past, have permitted over half of the Engineering Seniors to leave Cornell without knowing or joining our society.

In fact I believe it goes further. My experiences with Cornell Alumni over many years, and in many places, convinces me that a substantial percentage of our seniors leave Cornell without an adequate comprehension of their assets and responsibilities. Lacking this, their subsequent views and actions may not measure up fully to the great opportunities which lie before them.

I believe every undergraduate should understand th full significance of Cornell's founding and of its brilliant record of achievement and service over the years. They should know what Cornell stands for.

They should understand and appreciate the full significance of the "American Way of Life" as it exists in our wonderful country, and how unlimited are the opportunities that exist, and will continue to exist, as long as we jealously guard, and zealously work further to develop and improve this way of life.

When our Engineering Seniors graduate, they have behind them five years of exposure to the finest combination of good teaching, social influences, and traditions that exists anywhere.

They have won by their own efforts a degree in Engineering from an institution that ranks with the finest in the world.

They are heirs to Cornell's great reputation, and also to the unique and unexcelled acceptance which Cornell Engineers enjoy in industry and in the professions.

All Cornell Engineers enjoy these priceless assets. We should all work together constantly to maintain, and as far as possible, enhance them.

I hope, and have good reason to believe, that this year we have initiated a program which in 1949 will improve the conditions at Ithaca, and start correctives in the field among the 13,000 Cornell Engineers who are still not members of our society.

Alumni News

Testimonial dinner and program of tribute, attended by several thousand, were given September 28 in Altoona, Pa., in honor of **Frederick G. Grimshaw, M.E. '99, '00,** manager of the Altoona works of the Pennsylvania Railroad since 1925, who retires December 1.

Lloyd B. Jones, M.E. '04, engineer of tests at the Altoona, Pa. works of the Pennsylvania Railroad since 1937, retired November 1.

Leon M. Brockway, C.E. '08, of Providence, R. I., is supervising engineer of Narragannsett Electric Co.

Harry Eastwood, B.Chem '11, general superintendent of R. N. Nason & Co., San Francisco, Calif., and superintendent of the industrial products division of W. P. Fuller & Co., is president of the Golden Gate Paint, Varnish & Lacquer Association, a member of the executive committee of the Golden Gate Paint & Varnish Production Club, and chairman of the committee in charge of the paint technology course at San Francisco City College.

Sterling W. Mudge M.E. '13, supervisor of training for Socony Vacuum Oil Co., Inc., conducted a panel discussion on industrial training for the School of Industrial and Labor Relations this summer.

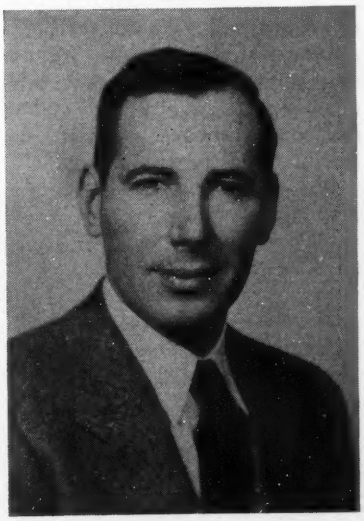
George H. Rockwell, M.E. '13, director of the Associates of the Harvard Business School since October, 1946, has been appointed special assistant to the dean of the School. He is a former Alumni Trustee.

Emile J. Zimmer, Jr., C.E. '26, has been appointed chairman of the special machine shop committee of the Commerce & Industry Association of New York. He is manager of the contract division of American Machine & Foundry Co.

Commander B. Otto Roessler, C.E. '31, C.E.C., USN was transferred last May from Pearl Harbor to the Bureau of Yards and Docks in Washington, D. C., where he is director of the contract administration division.

Julius F. Siegal, E.E. '30, resigned as works manager of the electronics components division of Super Electric Products Corp., February 13, to join Leonard Electric Products Co. On November 26, he was elected vice-president of Leonard Electric Products Corp., Brooklyn.

Eugene C. Schum, M.E. '35, has been appointed diesel engine sales manager of the Hamilton Division of the Lima-Hamilton Corporation. Mr. Schum joined the Nordberg Engineering Department in 1935, and from 1942 to 1945, he served in the Internal Combustion Engine Section, Bureau of Ships, Navy Department, Washington, D.C., with the rank of lieutenant commander, U.S.N.R. From 1945 until coming with the Lima-Hamilton Corporation, Mr. Schum held the position of district sales manager of the Nordberg Manufacturing Company.



Eugene C. Schum

George F. Carrier, M.E. '39, Ph.D. '44, son of Charles M. Carrier, '16, was promoted July 1 to professor of engineering at Brown University, Providence, R.I. From Cornell, where he was a graduate instructor in Machine Design, he went to do research on the Pratt and Whitney project at Harvard University before joining the Brown faculty in 1946.

Dudley A. Saunders, C.E. '39, B.C.E. '48, is superintendent for Slattery Construction Co. of New York which has just finished the Metropolitan Life Insurance Co. housing projects in New York City, Peter Cooper Village and Stuyvesant Town, and is now doing excavating work for the permanent UN headquarters in New York. His brother, John D. Saunders '48 is a field engineer for Slattery.

Robert B. Tallman, B.Arch. '42, '46, has received his New York certificate of registration as an architect. Beginning January 1, he will enter into partnership with his father, **Carl C. Tallman, B.Arch. '07,** under the firm name of Carl C. and Robert B. Tallman, architects. For the last twenty months he has been a designer and draftsman in his father's Ithaca office. Tallman enlisted in the Navy in 1942 and returned to complete his course in 1946 after four years as an ensign in the office of Admiral Nimitz at Pearl Harbor and Guam, planning hospitals, air fields, and other war emergency construction. Carl Tallman has conducted his own office for thirty-six years, and for the last fifteen years in Ithaca. He has designed and supervised some of the sorority houses at the University, the new press and radio box at Schoellkopf Field; emergency housing for Cornell and Ithaca College; and has prepared preliminary studies for the development of a new campus for Ithaca College. From 1942-4 he was architect for a war plant at Sidney.

(*Continued on page 32*)

Engineering Book Reviews

ELEMENTARY STRUCTURAL ANALYSIS *by John Benson Wilbur, Sc.D., and Charles Head Norris, Sc.D.,* 1948, *McGraw-Hill,* $6.00.

The title for this book is well chosen, in that it emphasizes the "elements" without too much digression into advanced fields of theory. The scope of the book is such that it conveys about the minimum essential information in the field of structural theory. There is also enough reference to original sources and more detailed treatments to enable the advanced student to pursue desirable topics further.

In nineteen chapters, structural theory is developed in quite logical sequence, with one notable exception which will be discussed below. The treatment of loads is well done in the first chapter, with a minimum of the usual stock phrases which serve to disguise physical concepts. The illustrative material, particularly with respect to trusses, would profit by being more pictorial. One could argue endlessly over definitions of terms when discussing "factor of safety," hence it is difficult to criticize the author's treatment of that subject.

The second chapter on Reactions is clear and concise, with some excellent illustrative problems. The third chapter on Shear and Bending Moment is standard, though the sign convention discussion is likely to cause confusion when applied to other structures than beams. The fourth chapter on Trusses is good. The treatment of Maxwell diagrams and Bow's notation in the fifth chapter is notably better than one usually finds in most texts on theory.

The subject of Influence Lines as discussed in Chapter 6 merits careful study. In this treatment, many of the more useful tricks in

(Continued on page 44)

SOIL MECHANICS: *Its Principles and Structural Applications. Second Edition. By Dimitri P. Krynine. McGraw-Hill Book Co., Inc.* 511 *pages.*

The Second Edition of "Soil Mechanics" by Dr. Krynine has been substantially expanded and enlarged to include much of the material developed by the Science of Soil Mechanics since 1941. One entirely new chapter has been added to cover some of the advances made during the war years. The radical methods practiced by the Armed Forces for building highways and runways emphasized the importance of soil mechanics to engineers, and the new stabilization and design procedures are included in the chapter on "Highway and Runway Subgrades." The other added chapter is entitled "Pressure on Tunnels and Conduits," and while the concepts presented there are not especially new, they should be adequately represented in any text of this nature. This chapter fills a decided void in the first edition.

One other important change was made in the arrangement of the chapters. In teaching soil mechanics to undergraduates, the logical order in discussing stresses and strains in earth masses is to consider shearing resistance first and then compression strains. This order was reversed in the first edition, but has been corrected now to allow a smooth consideration of the basic problem followed by chapters on shear and consolidation. These chapters have also been simplified by removing much of the technical discussion to Appendices.

The new edition of "Soil Mechanics" is an excellent text for college undergraduates in engineering, and is worthy of a prominent place on the practicing engineer's reference bookshelf.

Professor H. T. Jenkins
Civil Engineering Dept.

MATHEMATICAL SOLUTION OF ENGINEERING PROBLEMS, *by Mario G. Salvadori, with problems by Kenneth S. Miller, McGraw-Hill N.Y.C.,* 1948, x + 245 *pp.,* $3.50.

This is a text for use in a one semester course following the usual couse in elementary calculus. It is intended to give the student greater facility in applying his mathematical knowledge to the solution of engineering problems, as well as to introduce him to new techniques which can be used in such problems.

About half of the book is devoted to a review of important parts of algebra, analytic geometry, and calculus. The rest of the material consists of some slight extensions of these topics (such as hyperbolic functions and complex numbers), an extended discussion of the numerical solution of simultaneous linear equations, and an introduction to Fourier series. Each topic is introduced by some applied problem whose solution involves the technique to be studied, and there is a list of more than a thousand exercises to give the student practice.

The book will undoubtedly be a good one for teaching the material that it covers. It is questionable, however, whether a student can afford to spend so much time merely in reviewing his past mathematics and in working problems of the same general types as the ones he has worked in earlier courses. Also, the reviewer does not feel that such an elaborate treatment of linear equations is appropriate to this stage of one's mathematical education. In other respects, the book creates a good impression.

R. J. Walker
Professor of Mathematics

PRACTICAL ASTRONOMY, *by Jason John Nassau, New Second Edition, McGraw-Hill Book Company, N.Y.C.,* 1948. 311 *pages.* $5.00.

Practical astronomy, or field astronomy as it is called at Cornell, has been a part of the curriculum of the civil engineer for so many years that it, like the Light of Lincoln Hall, has become cloaked with tradition.

(Concluded on page 46)

Techni-Briefs

Frozen Metal Dies

To make dies quickly and cheaply for experimental stampings, one car manufacturing firm uses a metal so soft that it will melt in just plain hot water. Made of an alloy of bismuth, tin and lead, these metal dies are frozen in liquid nitrogen to a temperature of 320 degrees below zero, making them as hard as brass. Six to ten stampings can then be made before the die has to be returned to the nitrogen for rehardening. Instead of being forced to wait as much as six months for small steel dies, a company can now make sample parts within 48 hours after ordering a "soft" die.

Magnetic Thumb Tacks

Small magnets of Alnico III, an aluminum, nickel and iron alloy, are being used in a magnetic pin-up board. These magnets, which have an attractive force of 33 times their own weight, are capable of "tacking" several sheets of paper to a metal back board. Soon perhaps the days of tack-sore thumbs and pin-pricked fingers will be over.

An All-Weather Road

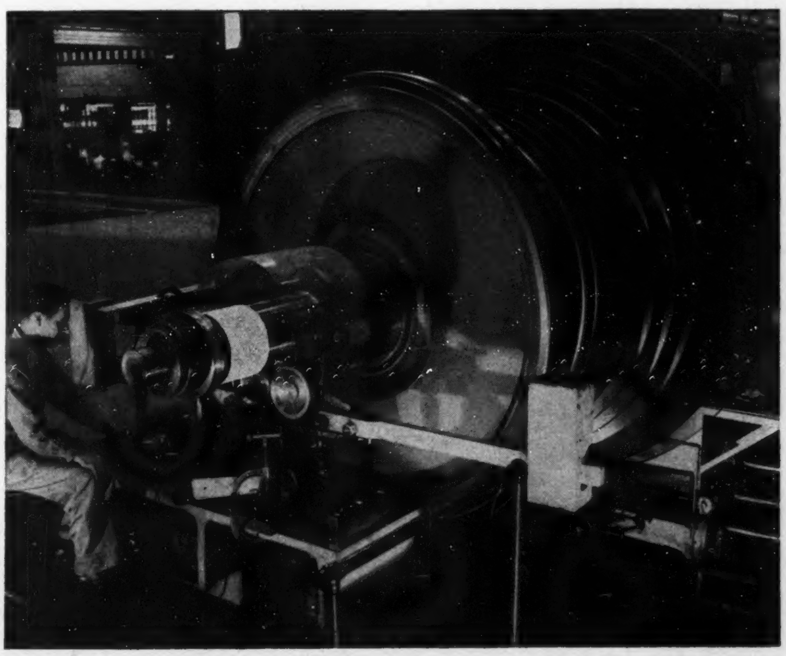
The motorist who has had the unhappy experience of not quite making it up an icy grade may well look with envy at the town of Klamath Falls, Oregon, where a stretch of "winter-proof" highway has been installed. This town has the advantage of possessing natural hot-water springs which it tapped for this purpose. There exists a particularly steep grade near the town which had long been a source of annoyance to stymied motorists. Highway engineers seized the idea of using this natural heat to keep this stretch free from ice and snow and thus went to work setting up a workable system. The method finally hit upon involves using this spring water to heat a circulating mixture of anti-freeze and water which is passed under the section of about 400 feet through a series of 30-foot grids. When the temperature drops below freezing, a thermostatically operated pump automatically begins to circulate the heating mixture through the pipes thus melting any surface ice or snow.

Underground Lab

To provide carefully controlled conditions for the ruling of diffraction gratings, Bausch & Lomb Optical Co., Rochester, is erecting a unique underground laboratory. The room is being built on solid rock, and will be insulated from temperature changes and vibration by concrete walls and by its location ten feet below ground level. The side walls will be made of layers of brick, waterproofing, insulating material, and 14-inch steel reinforced concrete. The floor will be 13 inches thick, with a special vibration-absorbing covering, and the ceiling will be 18 inches thick to support the 250 tons of earth above.

The building, which is 30 feet long, 16 feet wide, and nine feet high, will be kept within a tenth of a degree Fahrenheit by air conditioning equipment, and the inner rooms will be held to one hundredth of a degree while the ruling engines are in operation. The location of the laboratory was care-

A turbine rotor being checked for errors in weight distribution by a balance tester.
—Courtesy GE



These turbine shafts supply energy to six 82,500 kva generators.
—*Courtesy Westinghouse*

fully chosen so that vibration from the outside will be at a minimum.

These extreme precautions are justified by the high degree of accuracy necessary in ruling diffraction gratings, which are being used more and more because of the diminishing supply of optical quartz. A ruling engine must be able to scribe 15,000 lines per inch on a grating, and place them to an accuracy of one millionth of an inch.

Protection By Ice

Dry ice is not the most common or most likely packing agent for photographic emulsions but its use is required for keeping a new Kodak emulsion from breaking down under the influence of cosmic rays. This emulsion, developed by the Eastman Kodak research labs, is used for tracing the paths of atomic particles and thus is highly sensitive to anything of a similar nature such as cosmic rays. By certain analytic methods, the rate of energy loss of a particle may be measured by its record on the emulsion and thus extraneous traces must be eliminated.

Monel Metal Roofing

A new type of Monel sheet for roofing which has been developed by the International Nickel Company will last over one hundred years. It is available in standard roofing thicknesses and is adaptable for uses in corrosive atmospheres and salt air. This new roofing sheet is softer in temper and lends itself more easily to the various bending, forming, seaming, and soldering operations required in installation. The sheet has a low thermal coefficient of expansion and is unaffected by sudden temperature changes which normally affect most metallic roofing materials.

Steel Alloying Element

Titanium, a metal that has been of importance in the engineering field only as an alloying element for steels, will soon be an important engineering material in its own right. The Dupont Company has announced the successful operation of a pilot plant, set up to test the commercial feasibility of a new process for extracting the metal from its ore.

The process, which was developed by the U.S. Bureau of Mines, consists of reducing the ore to titanium compounds, which are reacted with molten magnesium in a furnace. The furnace product is a spongy form of the titanium, which is then melted and cast into ingots.

Fine alloy steel is produced through the use of this 70 ton electric-arc furnace.
—*Courtesy Westinghouse*

As an engineering material, titanium has great interest. In addition to being the fourth most plentiful metal in the earth's surface, in the pure form, it has a tensile strength equal to a good structural steel, but is only half the weight of steel. Its use, therefore, will result in structures equal in strength to those of steel, but of only half the weight.

Automatic Log

A device developed recently by GE allows a ship to keep a continuous record of its course in terms of the compass reading and the rudder position. This device graphs these quantities on a moving roll of paper and can be made to calculate the deviations from the straight and narrow path. Permanent installation of one of these "ship steering recorders" has not been made as yet but several are in use in Navy vessels as checks on automatic pilots.

Welding Electrode

A new type of manual arc welding electrode, designed to improve weld quality and at the same time lower welding costs, is now being sold by the North American Philips Company. Low spatter losses and a special coating increase deposition rates 25% to 100% more than a standard type electrode. Standard size joints may thus be made with fewer layers as more weld metal per pass is obtainable. The new electrode is available in lime ferritis, iron oxide, and organic types. Training time for inexperienced welders is shortened and less expensive quality control is required. Operator fatigue is reduced and a higher production rate per unit of time is obtainable. These electrodes may be used in all positions except vertical up and have automatic starting and re-igniting properties. The electrodes work satisfactorily with standard welding equipment on either AC or DC. Currents up to 600 amperes may be used for the 5/16 inch size.

Powerful Air Engine

A power plant which is designed to deliver more than 4000 horsepower to an airplane propellor in addition to developing several hun-

(*Continued on page 24*)

A 4800-horsepower locomotive gas turbine is shown dismantled for inspection.
—*Courtesy GE*

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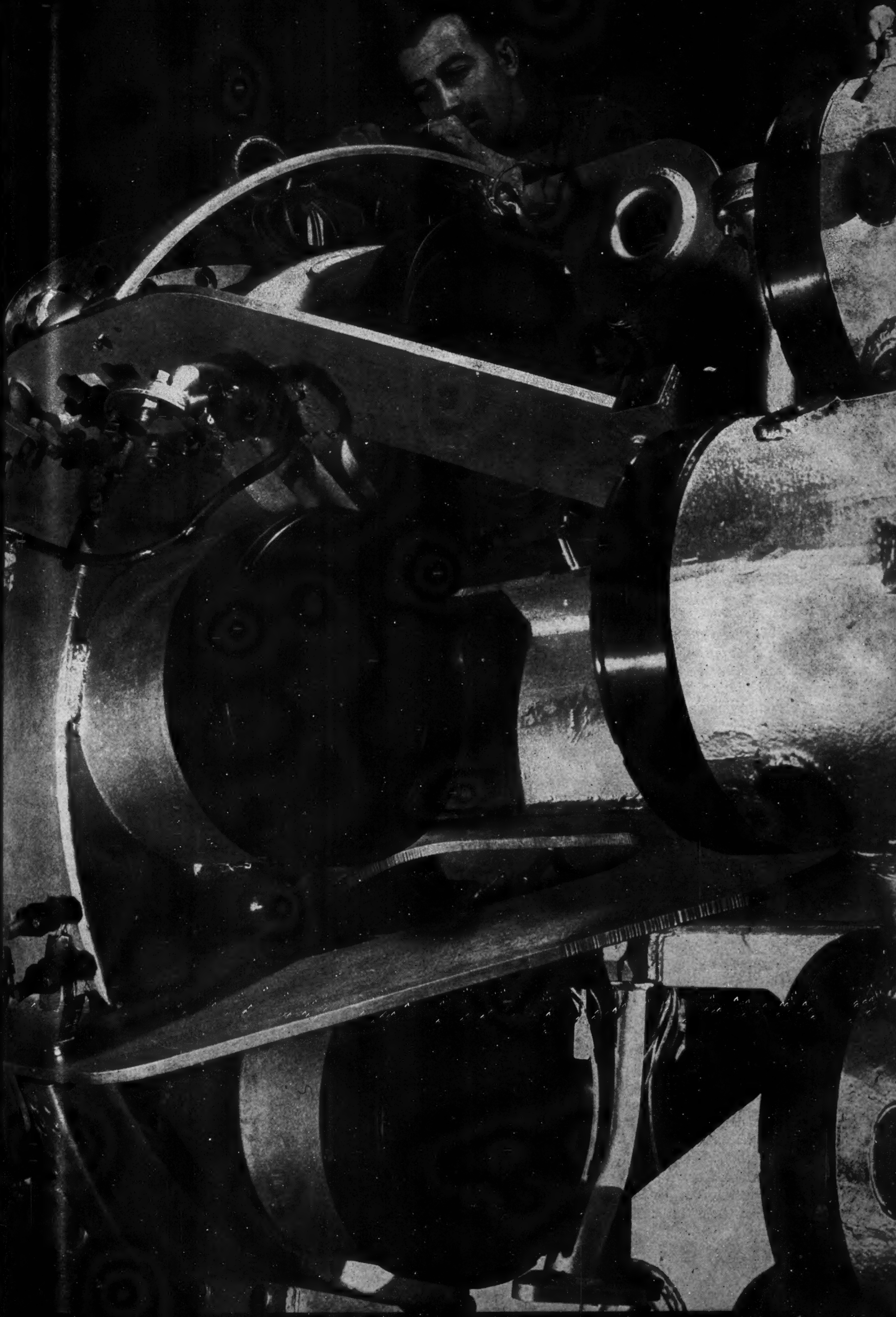
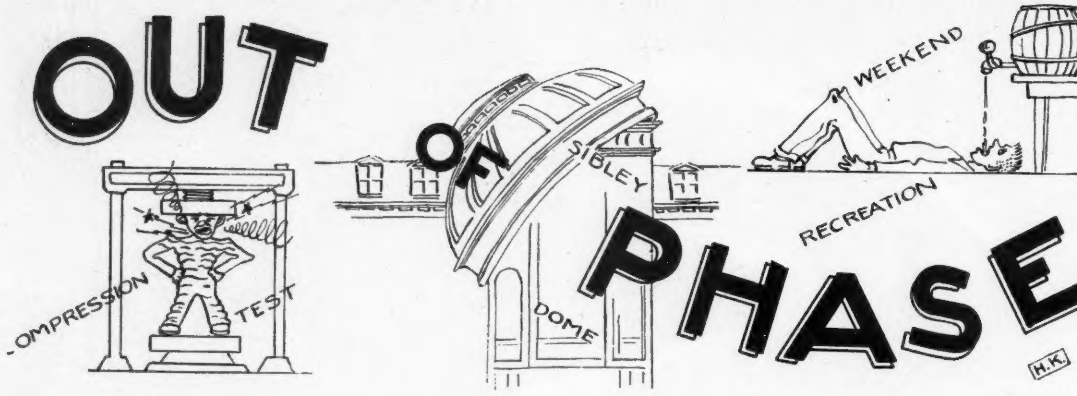




HERBERT F. SPIRER, EP '51

In the last month the student body has been informed of one rather interesting case of students being expelled from the University. Not to throw any doubts on the reporting ability of the Cornell Daily Sun, we would like to point out that such cases are not nearly so infrequent as casual observance of the headlines would show.

Only two weeks ago, Farnwhostle Pedfliesch, laboratory instructor in the college of engineering, was relieved of his duties through university action. While no mention of this appeared in the Sun, this reporter was fortunate enough to hear of the incident, and made a personal investigation.

The logical place for an investigation of this affair was the office of the Master-at-Arms of the Engineering College. This is an office little known to most engineers. It is responsible for the administration of professional ethics in the instruction of Engineering subjects. The present Master-at-Arms is Edible J. Parraflop, formerly a professional wrestler on the South African Veldt.

Obscure Office

In order to reach his office I descended into the third sub-basement below Sibley. Down in this dank, maloderous, cellar, far removed from the moans of the suffering engineers in the labs above I discovered the office. Daintily I scratched on the door.

"Either shut up or come in!" roared a voice out of the darkness.

When I entered Parraflop was seated on a pile of oily waste, his feet propped up on his desk, which was an empty packing case marked "Fragile, delicate instrument, handle with care—contents, one drop forge."

The walls were lined with bookcases, which were bulging with banned engineering textbooks. Over each shelf was a placard listing the reason for the banning of the textbooks below. Here was one section devoted to *Texts Found to be Unduly and Lasciviously Lucid,* one section for *Texts with too many Diagrams and Pictures,* another for *Texts giving All Steps in a Proof.* There were many such sections, and the subjects covered every field of engineering.

In the north corner of the room was a large rotary file labeled, FORBIDDEN TEACHING TECHNIQUES, and I was able to make out a number of subdivisions; 121.2: *Talking Clearly and Looking at Class,* 124.8: *Preparing for Class in Advance of Meeting,* 167.9: *Highly Verboten—Directly Answering the Student's Questions,* 190.7: *Explaining the Crucial Steps in the Solutions,* 204.5: *Being unduly Patient in Explaining a New Concept,* etc., etc.

Parraflop's bleary, but observant eyes noticed me studying the files, and he said,

"Glad to see that you are interested in our methods of maintaining the high standards in the engineering college. You might also be interested in what I am doing now."

Parraflop thrust a copy of an EE lab prelim under my nose.

"See this prelim? Well we got a couple complaints on this one. Class average too high, around 52. Seems like one of the four questions was not ambiguous. Oh, we've had a lot of trouble with the EE school. Found out that the proctors were answering questions about the prelim questions that the students might have while taking the prelim. That's unhealthy. Too many perfectly ordinary engineers were finding out what the questions meant. You can see what a bad situation that would bring on."

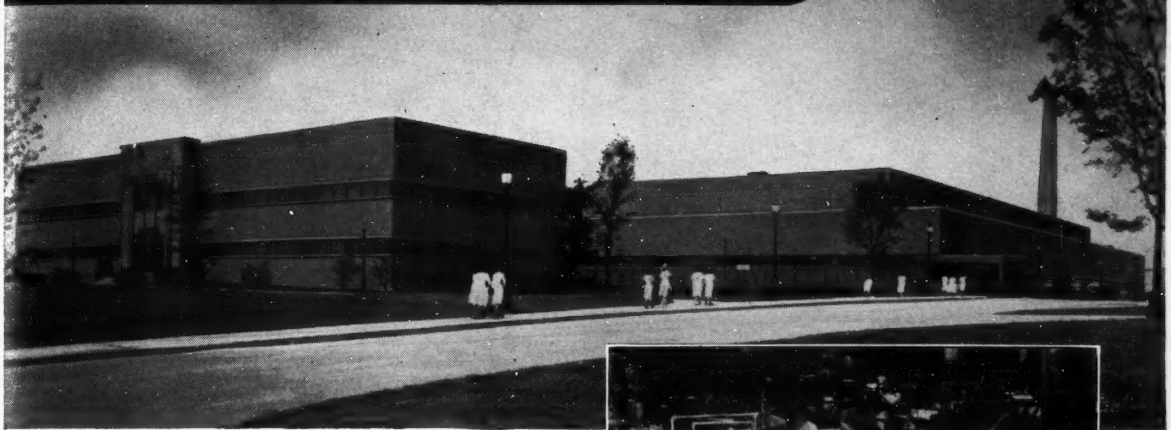
I nodded assent. He continued,

"So we went to work on them, and in two weeks I had the proctors following a new, more superior system. If the student has a question on the prelim, during the prelim period, we just have the proctor pass around a slip of paper telling those students to bring any questions they might have into the proctor *after* the prelim. This keeps the little devils alert during the prelim. Then, the moment the prelim is over, a special agent drives up to Franklin in a large black sedan. The proctors and instructors leap out of Franklin, prelims safely tucked away under their coats, leap into the large black sedan, which roars away in a cloud of dust to a hideout in Forest Home.

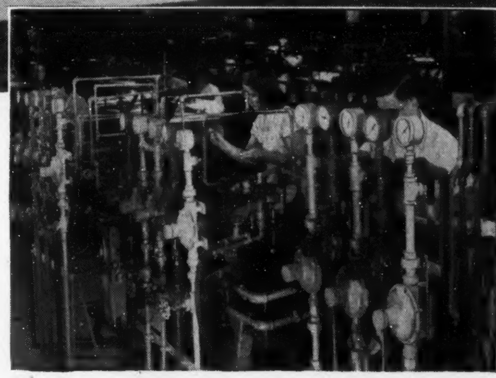
"Of course, this technique is only

(*Continued on page 48*)

Newsworthy Notes for Engineers...



New electronics plant of Western Electric at Allentown, Pa.



Over 40 miles of pipes deliver 13 needed services to working locations. These are hydrogen, oxygen, nitrogen, city gas, city water, deionized water, soft water (cold, hot, cooling) high pressure air, low pressure air, process steam and condensate return.

Complex job for Engineers

This new "controlled atmosphere" plant, which produces electronic equipment for your telephone service, posed many interesting problems for engineers at Western Electric—manufacturing unit of the Bell System.

For example, a speck of dust or a trace of perspiration may seriously impair the efficiency of vacuum tubes, thermistors, varistors and mercury switches manufactured here. To meet these problems, the new plant is completely air conditioned, with strict control of temperature and humidity—sealed except for doors, and slightly pressurized to keep out dust.

Assembling miniature electron tubes—typical of the high precision work at Allentown—calls for finest lighting. It is provided by a scientifically designed system containing over 13,000 fluorescent tubes.

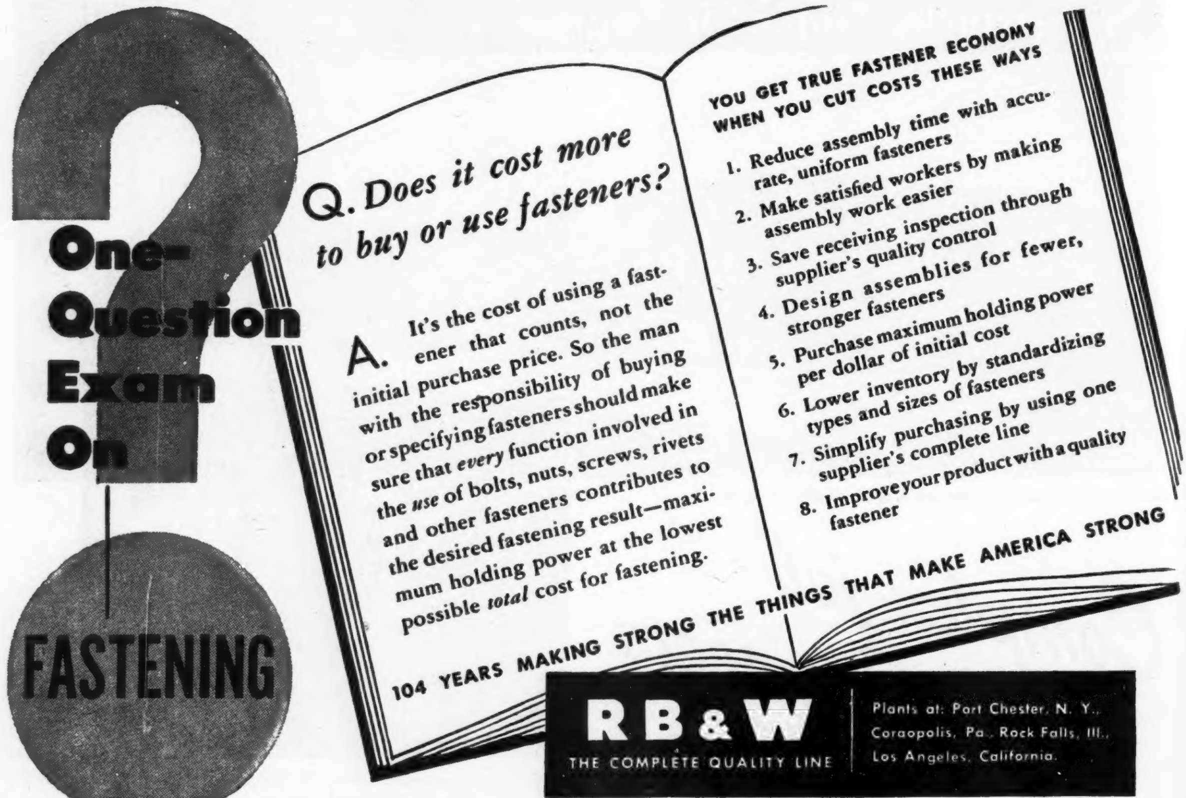
Other "musts" in planning included proper illumination for high precision work—a complex network of piping to deliver 13 needed services—a gas generating plant—a highly efficient chemical waste disposal system.

But beyond the problems solved in helping to design the plant itself, Western Electric engineers met many a challenge in working out highly efficient manufacturing layouts, machine design and production techniques to assure a steady flow of highest quality electronic devices of many types.

This new Western Electric Plant at Allentown is a measure of the ingenuity and thoroughness of Western Electric engineers—electrical, mechanical, industrial, civil, structural, chemical, metallurgical—who provide equipment that helps make Bell telephone service the best on earth.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882



RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Techni-briefs

(*Continued from page* 20)

dred pounds of jet thrust was announced this fall by the United States Air Force. This engine, known as the Wasp Major VDT, is a variation on the powerful Wasp Major design which previously held the record for a piston-type engine. The new contribution made through the joint efforts of Pratt and Whitney and GE in producing this device is mainly in the more efficient use of the waste gases. These are shunted through a two-stage turbosupercharger which first uses their energy to supercharge the combustion air used by the engine and then ejects the gases through the rear to either deliver additional power to the propellor shaft or to supply a jet thrust.

Accuracy Gage

Accurate measurements of displacements as small as 1/100,000 of an inch may be made with the aid of a device being developed by the National Bureau of Standards. The instrument consists of a tightly wound helical spring whose initial tension varies uniformly through its length. When external tension is applied and the ends are displaced the spring will move in a certain specified manner, changing the electrical resistance between the ends in an equally definite but much greater degree. Under no external tension, the resistance is that of a cylinder while for maximum tension the resistance is measured in terms of a long wire. Accurate measurements of this change in resistance thus give the displacement of the spring to a high degree of accuracy. Uses include strain gages, pressure gages, accelerometers, etc.

Lens Production

"The fastest optical machine of its kind ever developed" is the claim Bausch & Lomb apply to their latest eyeglass edging machine. Capable of edging 300 to 400 lenses a day, it will make both single and bifocal lenses and will use any type of glass. Spring tension control prevents lenses from turning in the holders and also provides absolute accuracy of lens size and shape. A precision lens chuck makes possible the exact centering of the lens. A new axis-setting gage cuts checking time from twenty minutes to three minutes. Production with this new lens edger is claimed to be more than double that with previous similar models.

Supersonic Parachute

An ordinary parachute would be of little or no use to a pilot attempting to escape from a supersonic, high-altitude plane in distress. A new GE device, known as a rotochute, may be the perfect answer to this problem. The "chute," a bullet-shaped metal capsule with a large propellor in its tip, operates on the same principle as a falling maple seed, decelerating

(*Concluded on page* 28)

liquid death!

They Die!

Esteron 245 destroys or inhibits herbaceous and woody growth, spares grass and allows the establishment of good sod.

THAT'S WHAT ESTERON 245 IS to tough, stubborn weeds and woody growth.

Weed and brush control along highways, power lines and other utility right of ways is important. Esteron 245, a close cousin of 2,4-D, was developed for weeds found resistant to that well-known compound. It is particularly effective against woody growth, osage orange, gum, brambles, hickory and oak.

An unusual feature of this plant hormone-type weed killer is that it kills by chemical action which accelerates the normal growth processes, resulting in death of the plant.

The development of Esteron 245, following Esteron 44 and 2,4-D, is indicative of the unceasing effort to better things that is characteristic of Dow research.

Dow produces more than five hundred essential chemicals from plants located in Michigan, Texas, California and Ontario, Canada. These include agricultural chemicals, the Dowicides (including PENTAchlorophenol—the chemical that increases the life of wood many years) plastics, which is becoming a by-word in everyday living, as well as major industrial and pharmaceutical chemicals.

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DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

Light Gage Steel

(Continued from page 7)

proach that has guided this investigation since its inception.

In many cases this sounds a great deal simpler than it is. Numerous were the times when we were on the wrong track, when test results just would not make sense, when theories would not click. Even today in some instances we are not sure whether what we think we know is definite and final, or whether it is just a reasonable and workable approximation which may stand in need of further work and refinement a short time hence. This is what research consists of, and one of the values of this project lies precisely in the fact that the numerous graduate students who have, over the years, participated in it have received not only a fundamental training in a somewhat advanced field, but have also acquired a thorough familiarity with, and often a great liking for research, its methods and its problems.

Light gage steel building panels, 0.048 in. thick, forming roof and floor of press box of Los Angeles Coliseum. Shape of box-like panels seen in lower left corner.

At the present time the American Iron and Steel Institute has at the printers a Light Gage Steel Design Manual. This Manual will standardize the more common new shapes and also will facilitate the use of the unfamiliar, new design methods by the practicing engineer. A second, revised and greatly expanded edition of the Design Specifications is now in the making which will incorporate such new research findings as have been made during the last three years. In all these undertakings the Steel Institute and its committees are working in closest cooperation and consultation with the Cornell investigators.

The commercial effect of this undertaking was not long in the making. The Design Specification has been incorporated in countless municipal and government building codes, opening the way for acceptance of such structures all over the country. During the past year it is estimated that about sixty million square feet of roof deck, and about eight million square feet of cellular floor panels were sold by the industry. No figures are available on steel panel walls, and on light structural shapes, but they are known to be of a comparable magnitude.

Indeed, to date the market has

(Concluded on page 28)

partners in creating

For 81 years, leaders of the engineering profession have made K & E products their partners in creating the technical achievements of our age. K & E instruments, drafting equipment and materials—such as the LEROY† Lettering equipment in the picture—have thus played a part in virtually every great engineering project in America.

†Reg. U.S. Pat. Off.

KEUFFEL & ESSER CO.

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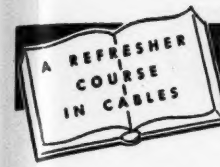
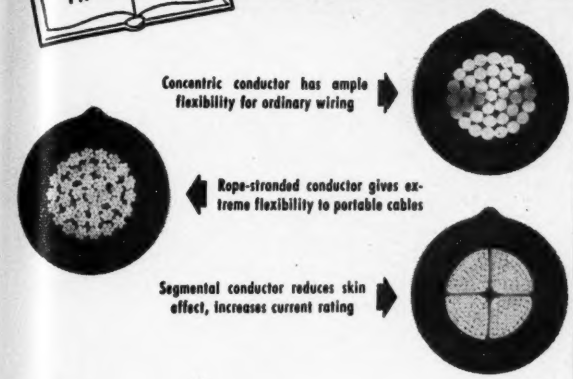


PERFECTLY-CENTERED CONDUCTORS



Uneven walls of insulation are a potential source of cable failure. Perfect centering of the conductor, however, is automatically provided by Okonite's Strip Insulating Process in which continuous rubber strips of ***uniform thickness*** are folded about conductor. Only by this method can insulation wall be gauged, inspected ***before application.***

Uniform walls of insulation are assured when you specify Okonite wires and cables. The Okonite Company, Passaic, New Jersey.

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OKONITE SINCE 1878

insulated wires and cables

YOU CAN LETTER
EXCELLENTLY WITH THE

New Doric lettering sets—
Made by Keuffel T. Esso Co. **$7.50**

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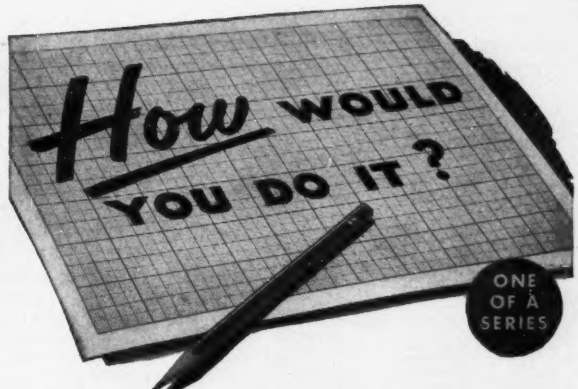
Have you seen the "Pocket Pal"—which has the most useful circles, hexes, deltas and squares—$1.00

And Now a Log Log Slide Rule—
Plastic by K & E **$12.00**

These are a few of the unusual items in our Engineering Dept. Why not drop in and let us show them to you?

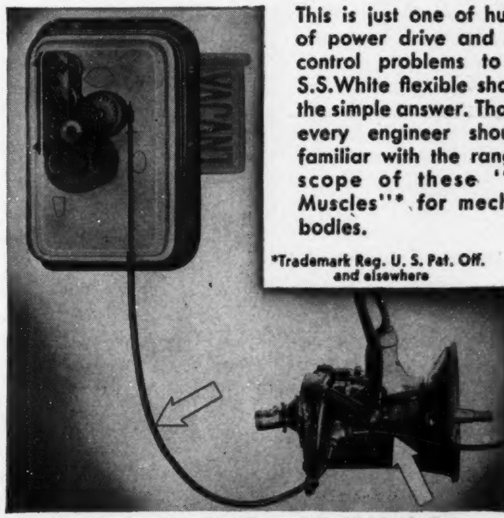
TRIANGLE BOOK CO-OP



PROBLEM—You're designing a taxi-cab meter. You have worked out the mechanism that clocks waiting time and mileage and totals the charges. Your problem now is to provide a drive for the meter from some operating part of the cab—bearing in mind that the meter must be located where the driver can read it and work the flag. How would you do it?

THE SIMPLE ANSWER—Use an S.S.White power drive flexible shaft. Connect one end to a take-off on the transmission and the other to the meter. It's as simple as that—a single mechanical element that is easy to install and will operate dependably regardless of vibration and tough usage. That's the way a leading taximeter manufacturer does it as shown below.

* * *



This is just one of hundreds of power drive and remote control problems to which S.S.White flexible shafts are the simple answer. That's why every engineer should be familiar with the range and scope of these "Metal Muscles"* for mechanical bodies.

*Trademark Reg. U. S. Pat. Off. and elsewhere

Photo Courtesy of Pittsburgh Taximeter Co., Pittsburgh, Pa.

WRITE FOR BULLETIN 4501

It gives essential facts and engineering data about flexible shafts and their application. A copy is yours for the asking. Write today.

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Techni-briefs

(Continued from page 24)

from the speed of the rocket or plane to about thirty miles per hour before landing. Use of the device is limited at present to the preservation of valuable test equipment built into rockets, as here the instruments may be freed from the rocket after it goes into its glide to destruction.

Reading By Electrons

The possibility that the blind will be able to read printed words is one step nearer reality with the development of an electronic scanning device by the RCA Laboratories. This reading aid operates on the principle that each letter of the alphabet will give a unique number of impulses when scanned by a specially-designed cathode-ray tube. This tube shines a vertical row of eight spots of light over each letter in a line of type and when a light spot hits a black portion of a letter, an impulse is recorded. The number of impulses for each letter is totaled and this total actuates a magnetic-tape recording of the letter it represents. This is then put out over a loud-speaker for the "reader" to hear. Thus far the apparatus is in the experimental stages and is limited to the reproduction of single letters but it is expected that in the future the device will be made more inclusive and more practical in size and cost.

Television Tubes

The copper screen used in the image orthicon television camera tube has to be by necessity the finest, most uniformly constructed mesh of wire possible. This was the problem facing engineers during the development work on the tube. The solution finally involved the production on a large scale of a mesh of 250,000 openings per square inch made by taking molds from a glass master on which the desired pattern has been etched.

Light Gage Steel

(Continued from page 26)

been limited primarily by the still prevailing shortage of sheet steel. It is mainly for this reason that the homebuilding field has not yet been invaded to a major degree by these new techniques, although substantial developments along this line are now in the making. To date not a single manufacturer has been able to obtain sufficient steel to meet his requirements, and countless orders for light gage construction had to be turned down. As soon as a better balance is achieved between supply and demand of sheet steel, the use of light steel shapes in building construction will result in mass production far beyond even the present large quantities. A farsighted industry should then be able to replace obsolete and prohibitively expensive building methods by industrial procedures and products at a cost within reach of the average citizen.

another achievement of Columbia's Technical Staff

Butoxyethyl Diglycol Carbonate—"BxDC"—is an important derivative of Diglycol Chloroformate. Developed by Columbia's Technical Staff, BxDC is living up to its laboratory potentials by serving as a valuable plasticizer in typical vinyl resins and butadiene-acrylonitrile copolymers. In addition, it is proving useful as a lubricant in Butyl rubber stocks compounded with the Columbia pigment, Silene EF, or other non-carbon pigments. BxDC also has excellent potentials as a high boiling solvent.

BxDC*

(BUTOXYETHYL DIGLYCOL CARBONATE)

COLUMBIA'S TECHNICAL STAFF, comprising Research, Development, Technical Service and Market Research, is continually engaged in developing useful chemical products—BxDC, for example—from Columbia's basic production of chlorine and alkalies. Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth at Bellefield, Pittsburgh 13, Pa.

***GENERAL CHARACTERISTICS OF BxDC**

[Diethylene Glycol Bis (2-n-Butoxyethyl Carbonate)]

$$O\begin{cases} CH_2CH_2OCOOCH_2CH_2OCH_2CH_2CH_2CH_3 \\ CH_2CH_2OCOOCH_2CH_2OCH_2CH_2CH_2CH_3 \end{cases}$$

Butoxyethyl Diglycol Carbonate is a new, colorless, liquid organic plasticizer. It is substantially insoluble in water and is very stable to hydrolysis by water. Only neutral products and carbon dioxide can be formed upon hydrolysis. It is soluble in a wide range of organic solvents and is further characterized by excellent resin compatibility, low volatility and high plasticizing efficiency.

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PITTSBURGH PLATE GLASS COMPANY

Industrial Safety

(*Continued from page 9*)

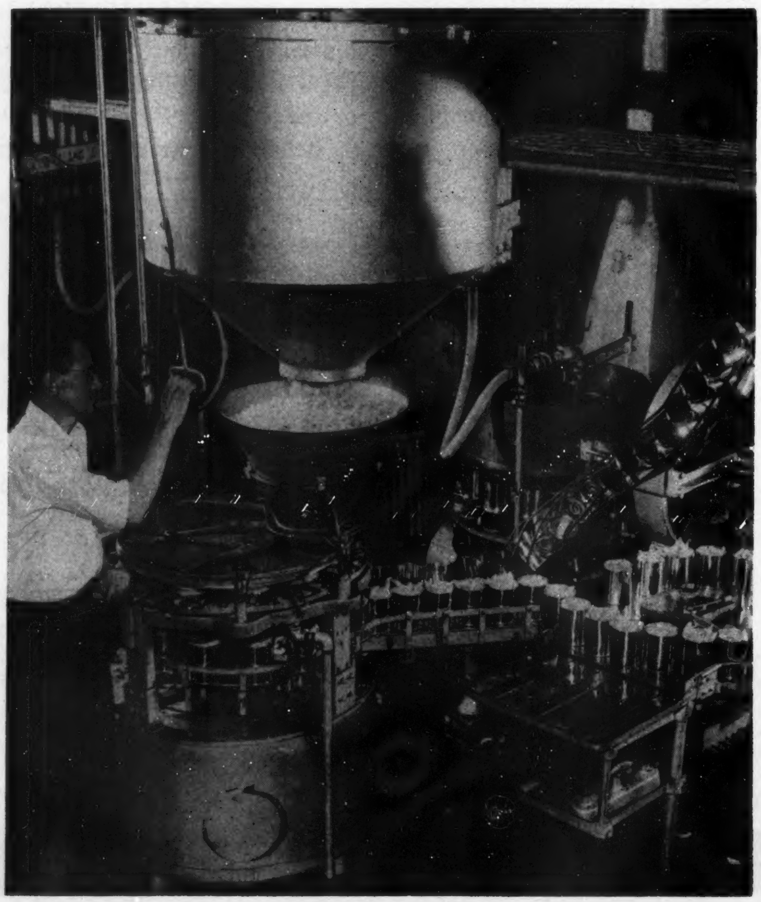
for someone to view such conditions impartially. Likewise, government has found it necessary because a few employers failed to recognize their responsibility for the protection of the lives of others, particularly of their employees.

There Are Many Hazards

The engineer in the design and the development end of industry has far to go to complete his job. In fact, it will never be done. The punch press and the circular saw have probably caused more needless human mutilitation than any other two pieces of equipment. However, these two hazardous pieces of machinery can be designed and operated so they will be safe. Where the desire to solve the technical problems has been strong enough, a solution has always been found. Practical methods of enclosing the dies in a punch press have been found. Likewise, the gang saw, even though it is mechanically fed, is protected by a barrier. Another outstanding example is the hazard created by the use and construction of exposed contact conductors on overhead bridge cranes. No one would think of having a bare wire carrying 110 volts strung around one's house, even at the ceiling. Yet we use 440 volts in bare wires or T rails along the craneway in a plant next to the catwalk where men walk to service the crane or have to step over the conductor to get into the crane cab. True, these wires are from twenty to forty feet above the ground where "no one ever goes." However, in California, 25 men were killed as a result of this particular hazard during the seven year period ending in 1946. Yet these conductors can be guarded either by physical shields or by the use of special conductors and contacts that do not expose the live parts, or by relocating the conductors.

Automatic filler machine fills a steady flow of cans with sliced peaches. A complexity of gears and belts, this equipment must be designed so as to afford protection to any operator.

—Courtesy Calif. Packing Corp.



Many other examples could be cited in every industry, on the farm, in the home, and on the highways, of the foolhardiness of the user and the lack of foresight on the part of the engineers. Frequently hind sight, derived from the experience of someone else's misfortune is the only way that the lesson is learned. But many of the corrective measures can be taken before someone suffers, if only the engineer would give serious thought to the problem in advance, and was able to visualize hazards before an accident occurred. Thus engineering, coupled with accumulated accurate knowledge and sound deductions, results in saving lives and making it possible for many more people to live and enjoy their full span of life.

Let us briefly summarize then—the engineer has a peculiarly significant responsibility for the safety of others because: his skill is the one that develops machinery which man ultimately uses; he is concerned with the operation of these machines and processes to produce good; and his entire profession was created because of the need for scientific methods in creating structures that would be safe for others to use.

Study Is Needed

Because the use of the equipment by the normal person is the ultimate destination of that which the engineer has created, he must recognize and study the possible abuses that will ultimately result, and attempt to visualize these abuses and their result before they occur. It may be necessary in some cases to revise his original design.

Every engineer should be thoroughly indoctrinated in the fundamental causes of accidents in general, and should amplify this knowledge by constant study in the field of his ultimate choice.

Each engineer should personally practice what he assumes others will do; namely, use all of our modern appliances and devices in the manner for which they were designed.

"—*The resources of civilization are not yet exhausted*"—WM. E. GLADSTONE

Why greater strength weighs less and less

CAN YOU MAKE three pounds of steel do the work of four . . . and stay on the job longer? The answer is YES, with *alloy steels*—steels that are combined with small amounts of other metals, such as chromium, vanadium, and zirconium, to develop or increase desired qualities. For example, it's the element, *chromium*, that gives the stainless nature to steel.

So great is the improvement in steel, when alloy agents are used, that a freight car of alloy steel can weigh 25% less, haul heavier loads, yet stay in service much longer than similar cars of ordinary steel. Alloy agents not only increase the strength of steel, they also extend its life through reduction of destructive factors such as rust, corrosion, and wear.

The use of better materials to make steel go farther and serve longer is especially vital to all of us . . . with steel mills unable to catch up, and ore supplies dwindling.

Industrial gases have a big role in steel's better performance, too. Compressed oxygen aids in cleansing the molten steel . . . the oxy-acetylene torch cuts steel sections to size—and welds them together if desired. Finished steel articles are given a harder, longer-wearing surface through "flame-hardening." And carbon, in the form of electrodes, makes modern electric furnaces possible . . . with their output of high quality steels.

The people of Union Carbide produce these and related materials for improving steel. They produce hundreds of other materials for the use of science and industry—to the benefit of mankind.

FREE: *Let us send you the new illustrated booklet, "Products and Processes," which shows how science and industry use UCC's Alloys, Chemicals, Carbons, Gases and Plastics. Just write—*

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Norton Printing Co.

317 E. State St. Ithaca, N. Y.

Alumni News

(*Continued from page* 17)

William E. Blewett, Jr., M.E. '18, is executive vice-president of the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., which will build the Navy's new 65,000-ton flush-deck aircraft carrier. As vice-president and production manager of the company from 1941-47, Blewett helped lead the production fight that resulted in the record delivery of more than 550,000 tons of frontline fighting ships to the U.S. Navy. Included in this tonnage of combat vessels of every major class were the airplane carriers Yorktown I and II, the Enterprise, Hornets I and II, the Intrepid, and the Franklin. At the end of the war, Blewett received the Certificate of Merit from the Navy Department for "his outstanding work in connection with ship construction and conversion during World War II," and last year was made a national vice-president of the Propellor Clubs of America in recognition of "his tireless effort to keep America's Merchant Marine the strongest on the sea." He is a director of the Newport News Co. and the North Carolina Shipyard, Wilmington. The new aircraft carrier, with an overall length of 1,190 feet and a total width of 236 feet, will be the longest warship afloat (ten feet longer at the waterline than the SS Normandie) and the seventh Navy ship too big to pass through the Panama Canal.

Walter A. H. Grantz, C.E. '20, is West Coast manager of Frederick Snare Corp., covering engineering and construction work in Chile, Peru, Ecuador, and Colombia.

A. Griffin Ashcroft, M.E. '21, was elected to the Presidency of Textile Research Institute, Inc. last November. He was previously Director of research and development of the Alexander Smith & Sons Carpet Co., Yonkers, N. Y. Mr. Ashcroft has been a member of the board of directors of the Institute since 1944, and was vice-president and chairman of its executive committee during the past year. He is a member of the board of directors of the American Society for Testing Materials and chairman of its sub-committee, A-3, on wool and its products, and a member of its administrative committee on ultimate consumer goods; a member of the consumer goods committee of the American Standards Association, and of the advisory subcommittee on fibers and fabrics of the National Research Council committee on quartermaster problems; and chairman of the technical committee of Carpet Institute, Inc.

Bernard S. Sines, C.E. '22, was recently appointed president of Southern Pacific Railroad Co. of Mexico. He was vice-president of the company previous to this appointment.

(*Concluded on page* 50)

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Prominent Engineers

(*Continued from page* 15)

John Darley

John came to the Telluride Convention here at Cornell in June. He enrolled in the fall as a sophomore in the electrical engineering college and moved into the Telluride house. A member of Delta Phi fraternity at Kenyon, he renewed his ties at Cornell.

Besides being an active participant in the Dramatic Club as an associate member, John is presently a member of the senior class council, Tau Beta Pi, Eta Kappa Nu, Phi Kappa Phi, and the Delta Club, where he leads the singing in many a rousing chorus of old and famous stein songs.

John is one of those lucky people you read about but never see. Following the Christmas holidays of '47, John was all set to buy himself a new Studebaker with odd bits of change he had picked up and saved. His mother decided that it was a waste of money to buy a car when all you had to do was write a jingle or two, enclose it with a soap wrapper or box top, and a new car was yours for the asking. You could have knocked him over with a feather when a telegram brought him the news that he had won a 1948 Ford, his mother having sent in the winning jingle in his name to the Chiffon Soap Chips contest.

With that kind of luck and the ambition to continue his schooling at either Harvard or Wharton business schools, John's successful future seems well assured.

Billie Carter

(*Continued from page* 14)

The problem is the development of a continuous process for the alkali fusion of sodium-benzene-di-sulfonate to produce resorcinol, a germicide and chemical intermediate of wide application.

Billie looks forward to applying her engineering education in either of her special interests, technical journalism or practical research. Since she has already proven her ability in the first by her tenure with this publication and her potential for the second by her scholastic achievements, we who have worked with her can scarcely doubt her immediate success.

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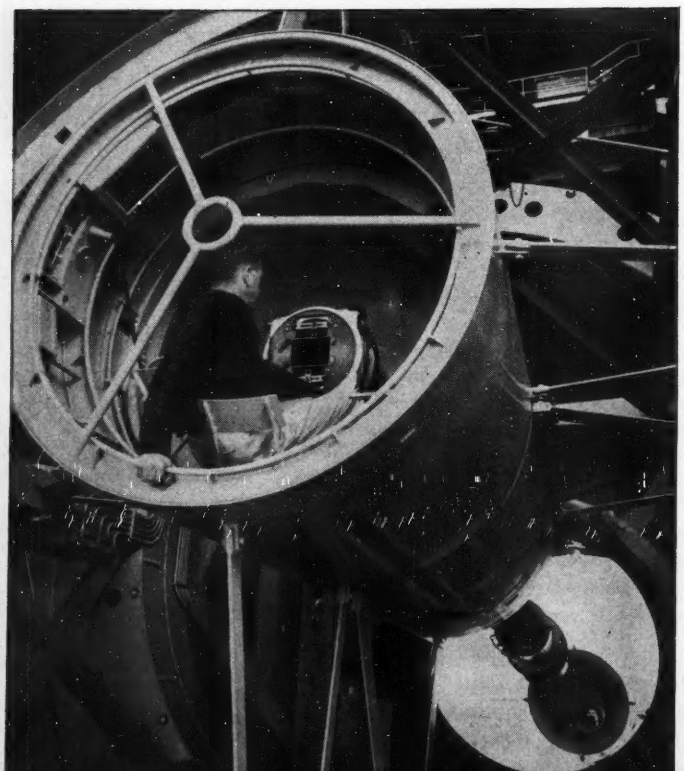

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The new telescope at Mt. Palomar moves its massive 500 tons with pin point precision on SKF Ball and Roller Bearings . . . over 5,500 SKF Bearings in all.

This is another of the interesting and imaginative assignments that cross the desks and drawing boards of the SKF Engineer. SKF Industries, Inc., Philadelphia 32, Pa. 6736

Industrial Ball and Roller Bearings

Engineered by SKF

Engineers review design of a new petroleum project. E. R. Wilkinson, L. S. U. '34; O. R. Menton, L. S. U. '38; W. A. Whitaker, Virginia '25; H. C. Leak, Mississippi State '43.

They're mighty good men to have around...

In times like these, engineers like the four shown here are mighty good men to have on the job at Esso Standard Oil—where our 28,000 workers today *average* almost 14 years with the company.

Their extra measure of skill, experience and job loyalty has set amazing records in *production* to help meet the high demand for gasoline and heating oil and other products.

One reason these extra-good workers are here today is simply the extra-good jobs they have at Esso Standard.

Over 30 years ago, the company set up an unusual "good jobs policy." It was based on the belief that better jobs would mean better workers, and that would mean a better company.

Since then, with our workers, we have developed plans which give every Esso Standard worker such job advantages as these: ***uniformly good wage scales... vacations with pay... special benefits in case of sickness or accidents... chance to advance in the company... cash savings in a Thrift Plan...fair treatment at all job levels . . . and planned retirement with steady income assured for life.***

All this was done as a matter of good business. It has given good business results. Not a strike or major work disturbance in over 30 years. Steady, skilful workers on the job. The development of new products from petroleum. New records in production to meet the country's needs. Yes . . . they're mighty good men to have around.

Esso

ESSO STANDARD OIL COMPANY

College News

(*Continued from page* 13)

Treatment Plant Redesigned

During the past summer Professors Bogema, Gifft and Jenkins formed a partnership for the purpose of taking on consulting work. Although they all work together on any job they undertake, the work is generally divided so that Prof. Gifft takes care of sanitation problems; Prof. Jenkins the structural design work; and Prof. Bogema the hydraulics.

This new organization has just completed its first job, which consisted of the redesign of the water treatment plant here in Ithaca. The plans have been tentatively approved by the Albany office, and are now in the hands of the city, where they are undergoing their final review.

Also included in the study, are plans for a new chemical building. A visitor to the plant as it is today will find that chemicals are stored in an inconvenient manner. This condition will be corrected by allocating space for the storage and handling of chemicals. The appearance of the main building will be changed by the construction of a new flat roof, and the elimination of certain windows. When this project is completed, it is expected that local water treatment facilities will compare favorably with those anywhere in the country.

Lecture On Atmosphere

Dr. Joseph Kaplan of the Institute of Geophysics at the University of California at Los Angeles, discussed the upper atmosphere of the Earth at a recent public lecture sponsored by the Cornell Chapter of Sigma Xi.

Dr. Kaplan has long studied the "afterglow" spectrum of molecular nitrogen. His early work gave spectra showing the negative and positive bands of molecular nitrogen much as in the spectrum of the aurora borealis. The work has led to a better understanding of how the aurora and night sky light are produced and is the best laboratory duplication of these radiations.

Dr. Kaplan, who also discovered atomic nitrogen in the earth's atmosphere, is a native of Hungary and a graduate of Johns Hopkins University with the advanced degrees from the same institution. He has been a member of the faculty at the University of California at Los Angeles since 1928.

American Society Of Mechanical Engineers

At a meeting held on January 13th two movies were shown—"The Evolution of the Oil Industry" and "The Story of Gasoline."

On February 10th Mr. P. T. Elliott of the Eastman Kodak Company spoke on "Machine Design."

American Society Of Civil Engineers

This term A.S.C.E. is presenting a series of six movies on subjects of interest to civil engineering students. The movies are shown every Thursday afternoon at 4:30, at places announced on the bulletin board in Lincoln.

A field trip to the Elmira fabricating plant of the American Bridge Company is planned for sometime during the first few weeks of the term. The exact date will be posted on the C.E. bulletin board.

It is urged that all members interested in serving on the program committee for planning the activities of A.S.C.E. call Neil FitzSimons at Ithaca 6959.

American Institute Of Electrical Engineers

A joint meeting with the Ithaca section of A.I.E.E. was held on Friday, January 7th. Over two hundred members and guests heard Dr. John Dewyre speak on "Design Features and Applications of the Cornell Syncrotron." At the meeting Ted Wienman was elected treasurer to fill the position left by Bob Whitman, who has left school to work in industry this term under the cooperative program. Following the meeting there was an inspection of the Nuclear Physics Lab, conducted by members of the laboratory staff.

A.I.E.E. is planning a regular series of meetings for the spring term, with guest speakers and movies on topics which will be of special interest to electrical engineers.

Pi Omicron

Two new members, Marjorie Leigh and Judith Schwann, were initiated into Pi Omicron on the afternoon of January 7th, following which an initiation banquet was held at the Straight.

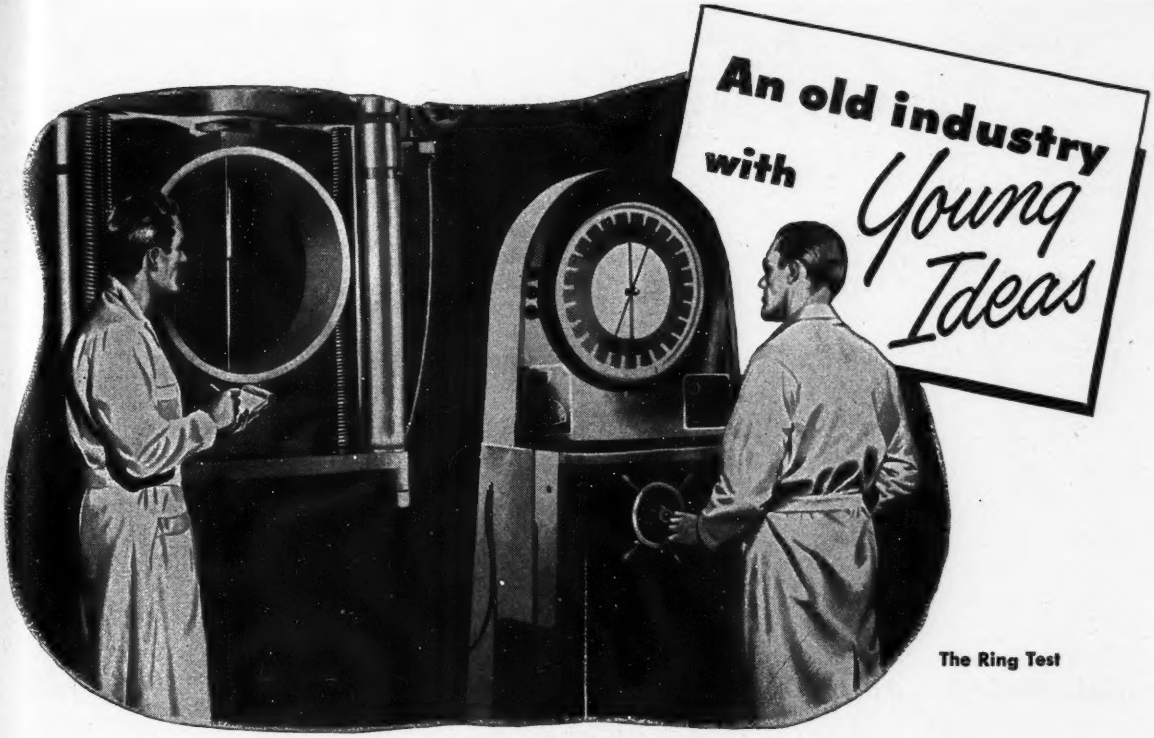
A general meeting of all women engineers was held on February 11th, at which time plans were discussed for spring term activities.

Pi Tau Sigma

On the afternoon of January 7th the Cornell chapter of Pi Tau Sigma initiated thirty-one men into membership. The initiation was directed by Warren Higgins, president of the chapter. The initiation ceremony was followed by the election of new officers for the spring term. The following men were elected: William Hansen, President; Richard Feyk, Vice President; Thomas Potts, Treasurer; David Kennedy, Corresponding Secretary; Spencer Robinson, Recording Secretary.

Following the elections a dinner was held at the Club Claret in honor of the newly initiated members. Dean Emeritus Dexter S. Kimball, the guest speaker for the evening, delivered an interesting and inspiring talk on "The History of Cornell." Kent Clarke served as toastmaster.

(*Continued on page* 38)



The Ring Test

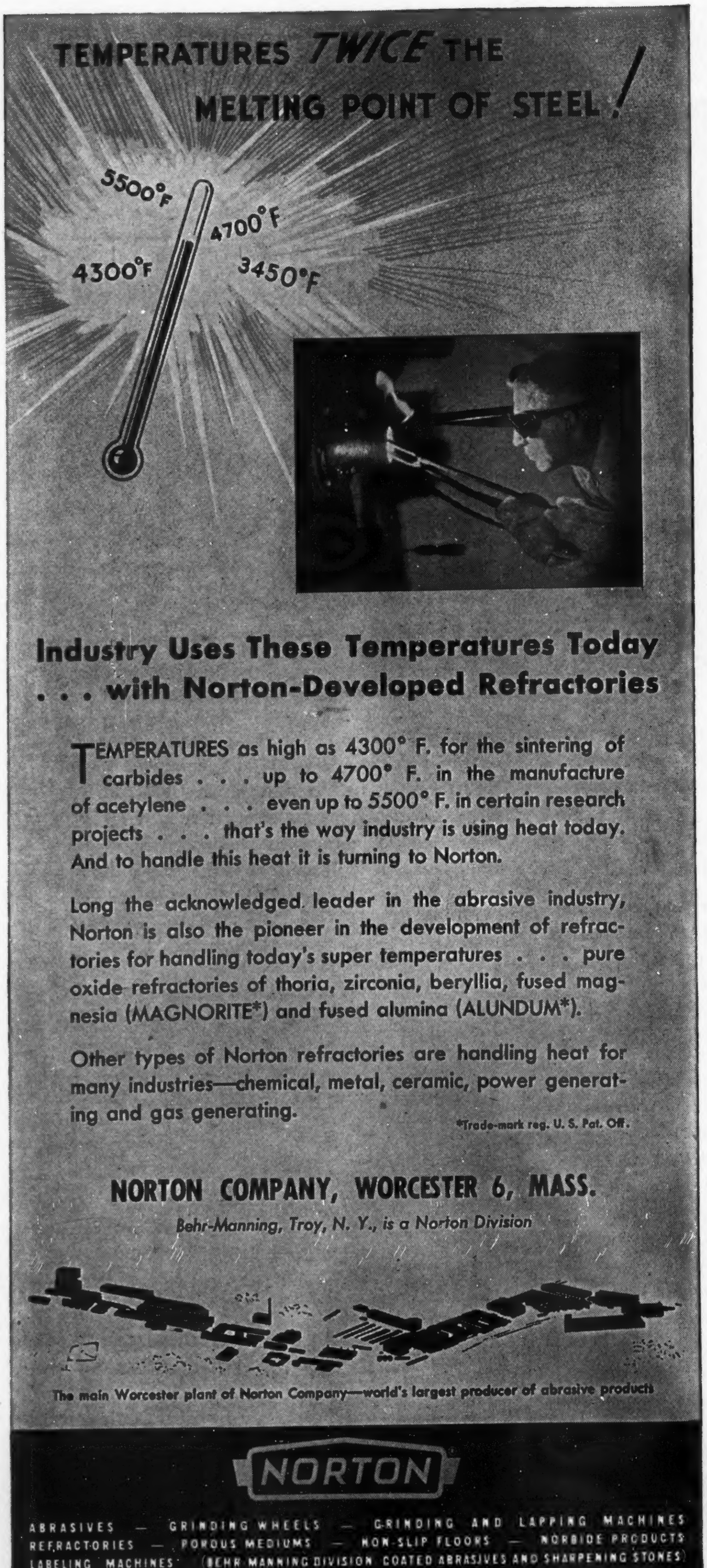
The ring test, shown above, is a scientific method for determining the modulus of rupture of pipe. It is not a required acceptance test but one of the additional tests made by cast iron pipe manufacturers to ensure that the quality of the pipe meets or exceeds standard specifications.

A ring, cut from random pipe, is subjected to progressively increased crushing load until failure occurs. Standard 6-inch cast iron pipe, for example, withstands a crushing weight of more than 14,000 lbs. *per foot.* Such pipe meets severe service requirements with an ample margin of safety.

Scientific progress in the laboratories of our members has resulted in higher attainable standards of quality in the production processes. By metallurgical controls and tests of materials, cast iron pipe is produced today with precise knowledge of the physical characteristics of the iron before it is poured into the mold. Constant control of cupola operation is maintained by metal analysis. Rigid tests of the finished product, both acceptance tests and routine tests, complete the quality control cycle. But with all the remarkable improvements in cast iron pipe production, we do not forget the achievements of the early pipe founders as evidenced by the photograph below of cast iron pipe installed in 1664 to supply the town and fountains of Versailles, France and still in service. Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction. Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3, Illinois.


Section of 285-year-old cast iron water main still serving the town and fountains of Versailles, France.

CAST IRON PIPE SERVES FOR CENTURIES



College News

(*Continued from page 36*)

Creed W. Fulton, President of the Cornell Society of Engineers, spoke before a group of graduating engineering seniors on Friday, January 14, on the subject, "The Transition from College to Business." This lecture was under the auspices of the Non-Resident Lectures Department, and was followed by a series of conferences with graduating engineering students for the purpose of giving professional guidance. This was then followed by a dinner in honor of Mr. Fulton in the Willard Straight Dining Room. Mr. Fulton then sponsored an informal party at the Seal and Serpent Fraternity House. The leaders of various student campus organizations were invited to attend, to discuss campus problems.

Geer Appointed Chairman

Professor Roger L. Geer of the College of Engineering at Cornell University has been appointed National Chairman of the Committee on Inspection and Gaging for the Instrument Society of America. Professor Geer developed the first formal instruction in precision measurement at Cornell. The Gage Laboratory is being developed under his supervision to include equipment for instruction and service to this area.

Air Photo Research

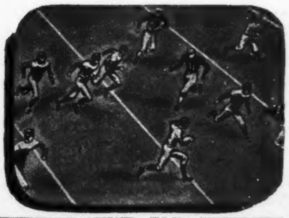
Aerial photographs on display in the Cornell University Library make the slogan, "One picture is worth 10,000 words," an old-fashioned concept.

Modern aerial photographic technique illustrated in the exhibit makes a picture worth thousands of dollars, and even more in some cases.

The showing, sponsored by the Air Photo Research Laboratory of the Department of Transportation Engineering here at Cornell, demonstrates the use of photography in highway, airport, and dam construction, land use planning, forestry operations, and other fields.

Most of the photos were used by

(*Concluded on page 42*)



Plastics where plastics belong

for high dielectric and structural strength, light weight and ease of machining

In the RCA television camera, for example, Synthane was selected for coil forms, tubes, flanges and other components because of its electrical insulating properties, especially at high frequencies and high voltages. Its ease of machining, light weight and structural strength were other factors that led RCA's design engineers to select Synthane as the best possible material for this job.

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Spans 20 Centuries in 41 Minutes

This new 16 mm. educational motion picture dramatizes, in sound and color, man's efforts to obtain inexpensive, abundant power by harnessing the energy released by combustion of fuels. Extensive animation and striking photography traces important steps in the 2000-year progress of steam power . . . from Hero's engine to the modern turbine, from the Haycock boiler to the latest developments in steam generating units for industrial and central station power plants. Stimulating and informative, Steam for Power will gladly be loaned without charge for showing to classes and student groups interested in any phase of engineering. Write for dates available.

N-63

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Low Temp. Research

(*Continued from page* 12)

having been noted with variations in temperature of as little as 1/1000 of a degree. This indicates some new and heretofore unexplained phenomena associated with the state of the metal at low temperatures, a phenomena which may, when fully explored, replace at least part of today's radio receivers with the less bulky and simpler strip of superconducting metal.

Superfluidity

Akin to the superconducting effect on metals produced by near-zero temperatures is the "superfluidity" of liquid helium. The liquid itself exists in two forms, called helium I and II. Helium I condenses below its critical point, 5°K; its properties are not unusual. At 2.10°K, under reduced pressure, helium I becomes helium II, which possesses certain remarkable features.

The first sign of helium's strange behavior was noted by Omnes in 1922. In an experiment with Dewar flasks, he found that helium could flow over walls, and that it always sought its own level. In 1935, Eilhelm, Meissner, and Clark observed its ability to flow through tiny orifices apparently without friction. This lack of friction therefore allows it to flow over surfaces with remarkable speed. Even more spectacular is the almost animal-like way in which it will creep up the sides of a small container to join the contents of a larger container, but will never go from the larger to the smaller. Furthermore, the small container never seems to empty, and measurements indicate that the smaller container will continue to empty itself for years, thus forming a "bottomless, inexhaustible well."

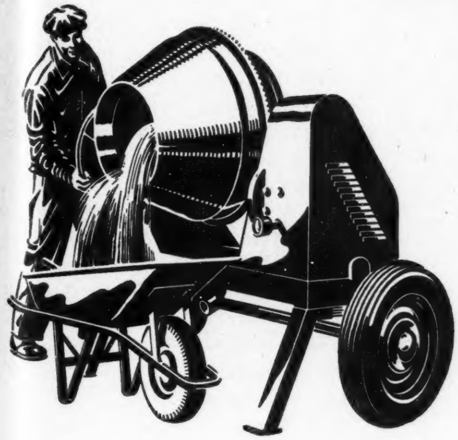
Importance of Helium

The ability of helium II to act in such a manner has been explained by supposing it to be a mixture of two components, one a sort of degenerate "gas" possessing viscosity, and the other type being superfluid, i.e. possessing no viscosity.

Aside from its interest as a laboratory curiosity, the true importance of helium II lies in the fact that it is apparently the only gross substance which obeys the laws of quantum mechanics. Among other things, this theory predicted the existence of "second sound," which is essentially a temperature wave. That it actually did exist was verified experimentally by the transmission of a fluctuating temperature wave through liquid helium. Second sound has one tenth the velocity of ordinary sound. Its frequency corresponds to that of middle C on the piano, and although it is within the normal range of hearing, it is inaudible. It ceases to exist when the temperature goes above 2.2°K. Thus far the main value of helium II lies in its permitting the study of the pure quantum state in large masses, instead of confining the investigation to particles of atomic size.

(*Concluded on page* 42)

Another page for **YOUR BEARING NOTEBOOK**

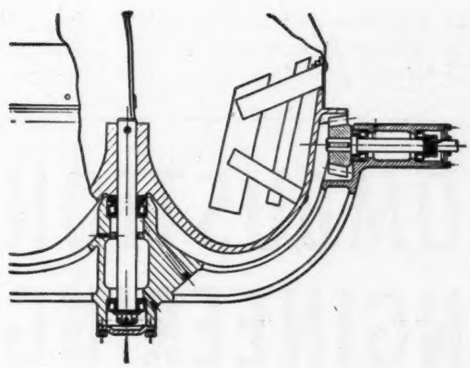


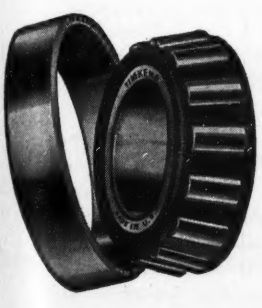
How TIMKEN® bearings pave the way for long life in a concrete mixer

Keeping concrete mixers from growing old too soon is the aim of construction equipment builders. That's why they use Timken® tapered roller bearings on drum shafts, driving pinions, and in the road wheels. Because Timken bearings practically eliminate friction and keep parts in rigid alignment, wear is reduced to a minimum.

TIMKEN® bearings keep gears meshing smoothly

This drawing illustrates how Timken bearings are used to insure smooth operation in a concrete mixer. Because of the tapered design, Timken bearings take thrust as well as radial loads. End-movement of shafts is eliminated and parts are held in rigid alignment. Timken bearings carry the heaviest loads with minimum shaft deflection. Gears wear longer—work better.





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TAPERED ROLLER BEARINGS

Want to learn more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

College News

(*Continued from page* 38)

Cornell research groups in world-wide explorations in recent years. Their work includes dimensional studies of soil patterns in Alaska and New Zealand.

Chi Epsilon

William A. Marskino of the class of 1952 has received the Chi Epsilon freshman scholarship award for maintaining the highest average in the past year's freshman civil engineering class. In addition to this tribute, Bill was also presented with a Design Handbook at Chi Epsilon's initiation banquet held recently.

This has been an annual award by the student chapter since 1933 except for the war years.

Pros-Ops

The following new members were elected to Pros-Ops, honorary chemical engineering society at a meeting in January.

Howard A. Acheson, Jr.
William C. Brasie
Joseph W. Calby, Jr.
John C. Colman
Marjorie W. Leigh
Robert A. Louis
Albert P. Oot
Leo A. Sears
Richard L. Shaner
Allen W. Smith
Howard M. Smith
David G. White

The newly elected officers are:

Leonard Roland, President
Roger W. Day, Vice-President
Billie P. Carter, Secretary
Wilfred R. Loeser, Treasurer

Low Temp. Research

(*Continued from page* 40)

Low temperature physics will also be of great help in studying effects otherwise unnoticeable by comparison with the thermal agitation that exists at temperatures higher than a few degrees Kelvin. Such delicate heat-measuring devices as the aforementioned bolometer might mean increased knowledge for astronomers of how much heat is given off by heavenly bodies. The only direct application forseen at present, aside from the accidental discovery of the ability of superconducting colombium nitride to receive radio signals, is the possibility of developing a zero-resistance alloy. But who can say that the advances in fundamental theory which low temperature physics has already made and will doubtless continue to make may not eventually have as far reaching an effect on the world as has the discovery of atomic fission in an obscure laboratory not many years ago.

COMBUSTION ENGINEERING *The BOOK of the YEAR*

for the engineering student interested in steam generation and related subjects

COMBUSTION ENGINEERING **is probably the most comprehensive technical book ever published by an equipment manufacturer. Its 30-odd chapters and appendix run to well over a thousand pages and include more than 400 illustrations and about 80 tables. It is designed for the use of both engineering students and practicing engineers.**

Among the subjects covered in this book are: the origin and production of coal; fuels for steaming purposes; fluid cycles; steam purification; feedwater; performance calculations; all types of stokers; pulverized fuel burning equipment; burners for liquid and gaseous fuels; furnaces for wood refuse and bagasse; all types of stationary boilers; marine boilers; forced circulation boilers; electric boilers; superheaters and desuperheaters; heat recovery equipment; drafts, fans and chimneys; selection of equipment; testing of steam generating units; and operation and maintenance of equipment. A full chapter is devoted to the A. S. M. E. Boiler Construction Code. The Appendix includes complete steam tables, and a Mollier Diagram is tipped in to the back cover.

Edited by Otto de Lorenzi, Director of Education, Combustion Engineering - Superheater, Inc. Size 6¼ by 9¼. 1042 pages.

HOW TO GET IT. **Although the list price of this book is $7.50, it is made available to engineering students at a nominal price. For particulars see the head of your mechanical engineering department or your instructor in heat power. Inquiries may also be addressed to the publisher.**

B-290

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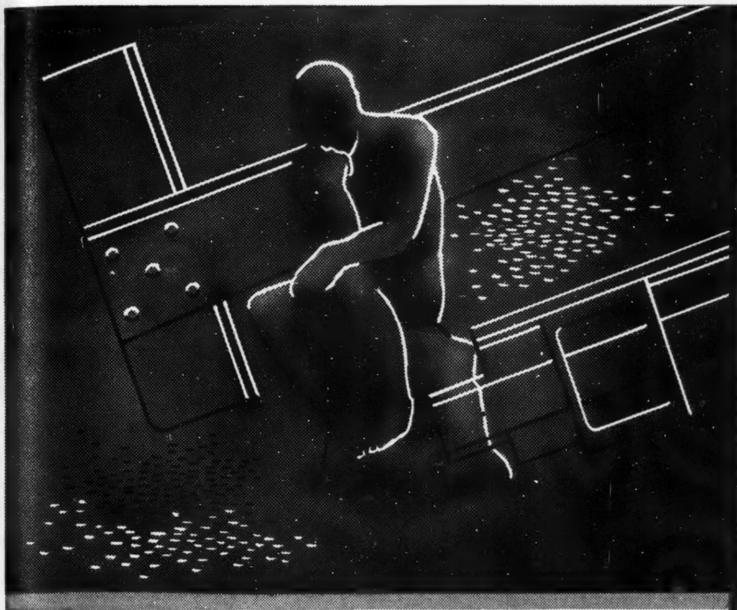

Thinking of improving

"Improving" any machine really means increasing its productive capacity. That means tinkering with speeds and weights and strength—ending up with alloy steels.

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Pottery with Cornell Seal, full 20 ounce capacity.

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The deluxe steins can also be furnished with Greek letters and with name or initials on special order. Prepare for Spring—come in and see the steins.

THE CORNELL CO-OP

Barnes Hall On The Campus

Book Reviews

(Continued from page 18)

Chapters 7 and 8 on Bridge and Roof Trusses, and Long-Span Structures are satisfactory save in respect to illustrative material. Many of the discussions could be made more effective with pictorial drawings instead of conventional two-dimensional line drawings. Chapter 9 on Three-Dimensional Frameworks is even more in need of pictorial sketches. (This may seem to be stressing the matter of illustration unduly, but for general reference purposes when the printed material is not supplemented by classroom discussion, illustrations must convey more than the bare outline of the message).

The material on Gravity Structures and Cables (Chapters 10 and 11) is quite satisfactory for a work of this scope. Both subjects would merit separate books of their own, but the fundamental principles are adequately covered in these two chapters.

Chapter 12 on Approximate Analysis of Statically Indeterminate Structures is the one which this reviewer considers to be out of order in the logical development of the book. The chapter in itself is good and conveys much useful material for checking general scale of solutions and for obtaining first trial designs. However, these approximate methods would better follow the more exact methods in order to forestall their misuse insofar as possible.

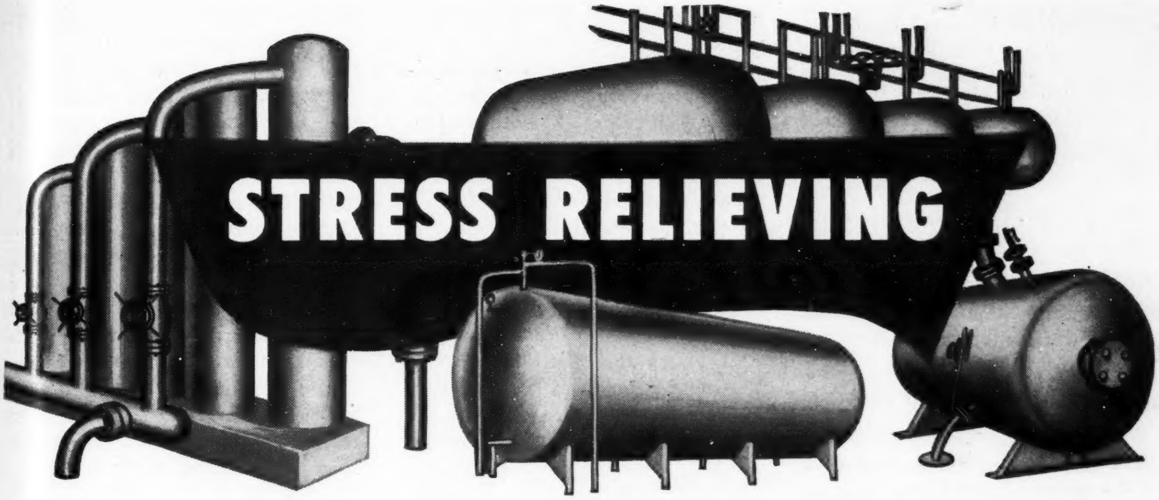
Chapter 13, Deflections of Structures, and Chapter 14, Statically Indeterminate Structures are very well done. The fundamental ideas are unusually well presented, especially Virtual Work. The relationship of geometry to deflection of structures is nicely pointed out, but is worthy of more attention and space. This same comment carries over into Chapter 15 on Influence Lines, in which the geometry part of the picture could stand more detailed treatment. Part of this is done later in the discussions of model analysis.

It is encouraging to note that Chapter 16 is devoted to a discussion of other structures than bridges and buildings. All too often, civil engineers are wont to ignore interesting structural problems simply because they arise in a field not usually labelled with a familiar tag.

Chapters 17 through 19 on Model Analysis provide worth-while tools for practical applications. The use of models to supplement or supplant theoretical computation is increasing. These chapters help to explain why still wider use of models may be expected in the future. One cannot read them without wishing to check some previous computations with a model, or work out some new idea.

Considered as a whole, this new book should find favor as a textbook for undergraduate study, as a starting point for advanced study, or as a useful addition to a structural engineer's library.

Dr. R. M. Mains,
Associate Professor
Structural Engineering.



Temperature Ranges Required for Pressure Vessels

at BLACK, SIVALLS & BRYSON, Inc.

Demonstrate Controllability of GAS

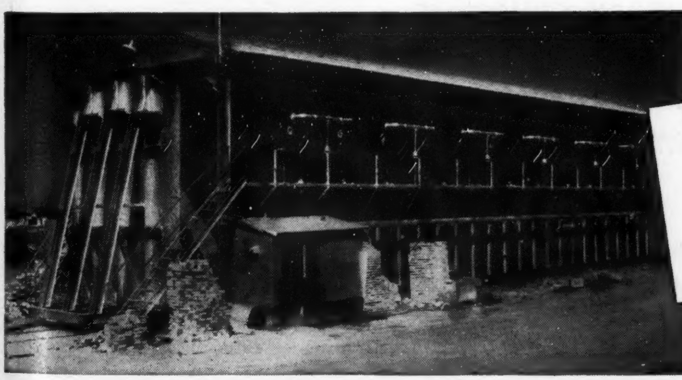
Safety codes govern many of the manufacturing and testing methods for pressure vessels. One of the most important processes, stress relieving, requires precise control of temperatures throughout the cycle—just the type of temperature control to be found in thousands of industrial applications of GAS for heat treating.

Specialists in the manufacture of pressure vessels depend on GAS for heat processing of all types. The pioneering firm of Black, Sivalls and Bryson, Inc., Kansas City, uses GAS in the manufacture of tanks, valves, pressure vessels and safety heads. President A. J. Smith says,

"Throughout the past 25 years we have depended on GAS to provide the exacting temperatures for our work. In many of our plants we have developed special GAS equipment; our large stress-relieving furnace at Oklahoma City is a typical example."

In this large furnace the GAS control system is arranged to provide temperatures up to 1200° F. for any time-cycle required. Automatic regulators and recording pyrometers assure maximum fuel efficiency while the flexibility of GAS is an important factor in maintaining production schedules on vital equipment.

Stress-relieving is just one of the applications of GAS for heat processing. You'll find hundreds of other uses for the productive flames of GAS—they're worth investigating.



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One of the largest stress-relieving ovens in the United States, this installation at Oklahoma City is 77' long, 12' wide, 18' high—Gas-fired and equipped with recording pyrometers.

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Book Reviews

(*Continued from page* 18)

Memories of the long walk to Fuertes Observatory with brief solace within Johnny Parson's cheerful walls, of hands and feet numbed by cold of early spring nights, of clouds scudding across the sky to ruin an observation, of flashlights going dead just one observation too soon, blended with dubious personal accomplishment in unraveling the mysteries of astronomical triangles, have led not a few student engineers to entertain grave doubts as to the practicality of practical astronomy.

For years the basic text at Cornell has been Professor Nassau's *Practical Astronomy*, so long in fact that fair trade-in value at the local bookstores can be relied upon to net the needy student a dollar or so. But now, at long last, the old and well worn books must yield to a new edition.

The new second edition of *Practical Astronomy* is a complete revision with respect to both content and method of presentation. The book is now, strictly speaking, two books within one cover. Part I treats of the fundamental principles of observational techniques based on the ordinary transit and sextant, and of reduction methods dependent on the American Nautical Almanac. Part II, on the other hand, treats the more precise instruments such as the zenith telescope and meridian transit, and of reduction methods utilizing the American Ephemeris and the Standard Star Catalogs. This division of subject matter, together with the use of the Nautical Almanac, has long been recognized as a desirable procedure at Cornell. It is unfortunate, however, that the appearance in 1950 of an entirely new type of Nautical Almanac, greatly resembling the present Air Almanac, will necessitate an immediate revision of Part I.

Illustrations in the book include many well chosen photographs and drawings. The latter are carefully drawn and are not over-cluttered with information. Well-organized appendices include a short treatment of spherical trigonometry and a series of fourteen observation and reduction forms. The latter are especially useful to the occasional user of practical astronomy in avoiding loss of time from inadvertently overlooking an essential datum. And last but not least, the inclusion of answers to all problems will be a boon for refresher work or self-instruction.

The *New Second Edition of Practical Astronomy* will experience little competition for top rank among texts on this subject in any language.

R. William Shaw
Assoc. Professor of Astronomy

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DU PONT *Digest*

For Students of Science and Engineering

PRODUCING METALLIC TITANIUM FOR INDUSTRIAL EVALUATION

Du Pont group research developed a pilot plant with daily capacity of 100 pounds

Du Pont research has just made available to industry what may become one of America's key structural materials, titanium metal. Midway in density between aluminum and iron and with an especially high melting point, silvery-white titanium offers an extraordinary combination of strength, lightness, corrosion resistance and hardness.

Titanium is the ninth most common element. But it has been slow in coming into its own as a metal because of the difficulty of separating it in pure form from its ores.

Men pictured *on this page were members of titanium research team. E. L. Anderson, A.B.Ch., Brigham Young '40; J. B. Sutton, Ph.D.Phys.Ch., West Virginia '35; A. R. Conklin, M.S.Phys.Ch., Georgia '40, are shown inspecting 300 lbs. of Du Pont titanium metal sponge.*

Du Pont scientists first began to probe the possibilities of metallic titanium in the course of their long experience with the titanium oxide pigments. Their research was interrupted by World War II. Meanwhile, the U.S. Bureau of Mines laboratories succeeded in producing the metal for research purposes.

After the war, Du Pont scientists developed a process for the production of ductile titanium metal that can be scaled up to meet commercial demands. The research team that mastered the complex problem consisted of chemical engineers specializing in design and production, as well as chemists and a metallurgist. In September 1948, a pilot plant was opened with a daily capacity of 100 pounds. Titanium metal is now being produced in sponge and ingot form. Samples are available to industrial and college laboratories with research projects in related fields. Studies of methods for forming, machining and alloying are under way.

Exhaustive studies will be necessary before the many possibilities of titanium metal can be known. Because of its high ratio of strength to weight, early uses may be in airplane power plants and structural parts. Its hardness and rust-resistance recommend it for railroad transportation equipment, marine power plants and propellers, and food packaging equipment. Its high melting point suggests use in pistons, and its resistance to electric currents points to electronics. Titanium wire may be used for springs and titanium sheet for such highly stressed parts as microphone diaphragms.

Your Opportunity in Research

The commercial development of titanium metal is a typical example of Du Pont research in action. However, the Pigments Department, which worked out the process, is but one of the ten Du Pont manufacturing departments. Each conducts continuous research. Each is operated much like a separate company. Within these "companies"—whose interests range from heavy chemicals to plastics and textile fibers—college trained men and women work in congenial groups where they have every opportunity to display individual talent and capabilities. Who knows what their contributions will mean in the future to science and the world!

C. M. Olson, *Ph.D.Phys.Ch., Chicago '36, and C. H. Winter, Jr., B.S.Ch.E., Virginia Polytechnic Institute '40, removing 100-lb. titanium ingot from furnace in heat-treating study.*

R. C. Reidinger, *B.S.Ch.E., Princeton '47, and T. D. McKinley, B.S.Ch., Worcester Polytechnic Institute '35, making a test of the hardness of ingots of Du Pont titanium metal.*

THIS BOOKLET WILL HELP YOU

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Send for your personal copy of "The Du Pont Company and the College Graduate." Describes opportunities for men and women with many types of training. Explains how individual ability is recognized and rewarded under the group system of operation. Address: 2518 Nemours Building, Wilmington, Delaware.

DU PONT

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More facts about Du Pont — Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

WRITE TODAY *for "The Du Pont Company and the College Graduate"*

Out of Phase

(*Continued from page* 22)

as useful as the prelim questions are ambiguous. An occasional prelim, like this one, slips through with a clear question and we have to punish someone. Just listen to this—'What is the most accurate method of measuring a resistance less than one ohm? Draw a diagram of a circuit that might perform this function'."

He pointed a gnarled finger at me. "Now do you see why we can't have questions like this on a prelim? 'What is the most accurate—' immediately the student knows what we want, and that's not good. We will change that to, 'What is the best way—' Now we have room for all sorts of interpetrations. Now for this '—less than one ohm resistance—' business. This gives away the problem. We will revise it so that it reads 'What is the best way of measuring a low resistance?' Now we have a question. Both 'best' and 'low' have a hundred meanings."

"But there is still some work to be done on this here question. Take the second part, 'Draw a diagram of a circuit that might perform this function.' That's horrible. Why anyone who had an understanding of the elements of resistance measurement could answer that question. No, we will change that to read "Draw the circuit diagram of the L & N type 440 N, triply compensated, bifocal, 1876 model of the Low Resistance Measuring device. Include a scale drawing of the external appearance of the instrument, showing which way the grain runs in the wooden case and cover.' Now, and only now, do we have a real prelim."

Why the Visit?

Parraflop, obviously pleased with himself, leaned back and thrusting his thumbs into the armholes of his vest fanned the air with his elbows. "What brings you here, Rodney?," he queried.

"Pedfliesch, Farnwhostle Pedfliesch," I said getting right to the heart of the matter. Parraflop winced as I mentioned the name, and nervously chewed on an old twist drill.

"I want to know why Pedfliesch was thrown out of the university, and I know you know all about it. It's no use trying to keep the secret any longer, too many people already know about it. Marv Yusselfliesch is writing a letter to the Sun tomorrow, and every day thereafter for two months."

Parraflop knew he was licked. He was angrily flattening out his left hand with a twelve pound ball peen hammer.

"All right, Percy, you win. Here's the way it happened. We've been hearing of stray students learning something in Power Lab. Not too frequently, but often enough to be annoying. God knows, we've tried to prevent it, we put six men on each experiment, we keep the lab instructions vague, we find new places every week for the instructors to hide. But we knew that there was a leak somewhere."

(*Concluded on page* 50)

Mercury, "messenger of the gods," was slow compared with Ultrafax—which moves at the speed of light.

This messenger
delivers a million words a minute

Recently, at the Library of Congress, a distinguished audience saw documents flashed across Washington by a new means of communication . . . and reproduced before them in *facsimile.*

This was Ultrafax in action—a super-fast television communications system developed at RCA Laboratories. Reproductions of *any* mail—personal, business, or military . . . including police descriptions, fingerprints, bank drafts, government records—can travel at 186,000 miles a second!

Material to be sent is placed before an RCA "flying spot" scanner, and transmitted by ultra-high frequency radio signals. Miles away the pictures appear on a picture tube and are photographed. Negatives are ready for printing or projection in 40 seconds.

Eventually, when Ultrafax comes into commercial use, a complete Sunday paper—every word, and every single picture—may cross America in 60 seconds . . . a letter in the twinkling of an eye.

Science at work . . .

Ultrafax is but *one* of scores of major achievements pioneered at RCA Laboratories. This leadership in the fields of science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

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Examples of the newest developments in radio, television, and electronics may be seen in action at RCA Exhibition Hall, 36 W. 49th St., N. Y. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
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- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

Out of Phase

(*Continued from page* 48)

"I did the only ethical thing that could be done in such a case. I hid in a one ohm standard resistor before lab started. I didn't have a long wait, for in ten minutes Pedfliesch and an unidentified student entered, talking. I listened and heard Pedfliesch say,

'No, that's ok, son. I'm not assigned to your experiment, but I'd be glad to try to help you. What is your trouble'?"

At this point in his story, a great look of despair came over Parraflop's face, and he rolled his eyes heavenward.

"Can you imagine that? After all we had taught him, all the subtle dodges we supply . . . and he is going to answer a question. Oh, there were a hundred things he could have done. He could have become indignant and said, 'This isn't my experiment, go find the assigned instructor,' or he could have just frowned, as if he were deep in some new abstract theory, and walked away, silently. Or he could have said, 'Obviously you haven't given this problem enough thought—go back and think about it for a few more hours.' But no, after we take this man into our confidence, feed him, house him, clothe him, pay him ridiculously high wages, give him pleasant working conditions, he stabs us in the back. *He* was going to answer a question.

"I jumped out of my hiding place in the standard resistor and arrested both the culprits. The course of further action was all too clear. We cannot have radicals like that around here. He was tried by a faculty tribunal and eliminated. It was the best we could do, some damage was done, but we must keep it from spreading. After all, we do have our standards to maintain."

Yes, Parraflop, I thought. We do have our standards to maintain. O tempora, O mores, O Sibley.

Alumni News

(*Continued from page* 32)

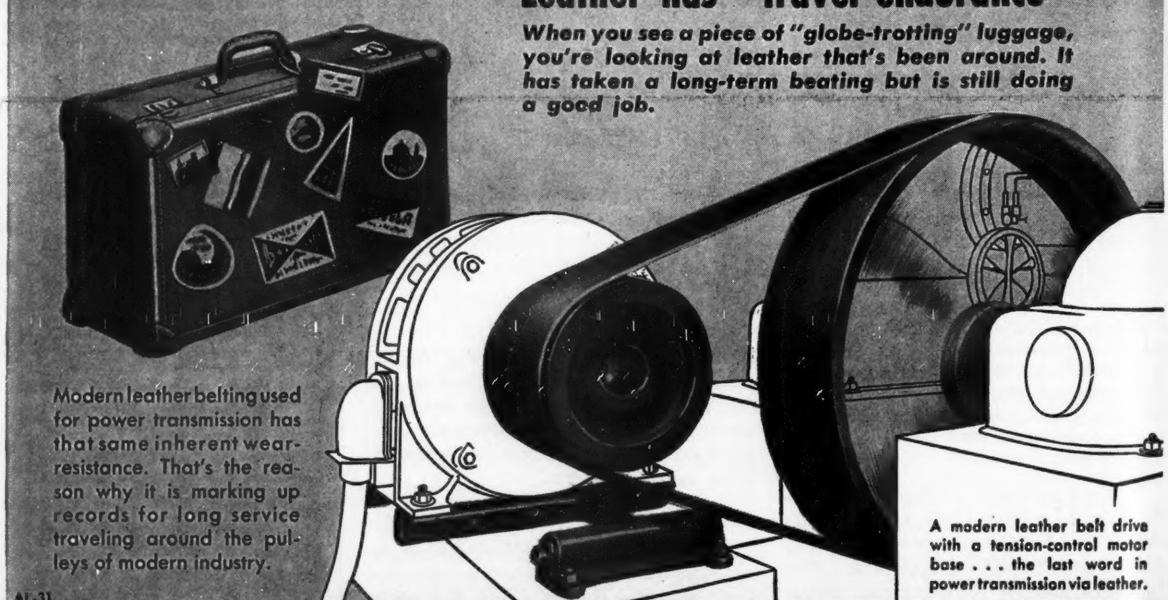
Dr. Byron E. Short, M.M.E. '36, Ph.D. '39, professor of mechanical engineering at the University of Texas, is serving as acting dean of engineering there for the period, April, 1948, to April, 1949.

Deceased

John W. Heller, C.E. '01, of Glen Wild Lake, former member of the tax assessment board and director of the Maplewood Bank and Trust Company, died recently in his home of a heart ailment at the age of 70. He was an engineer specializing in construction of dams and lakes. He was a member of Cornell Clubs of New York and New Jersey, the Civil Engineers Club of New York, Brooklyn Engineers Club, American Society of Civil Engineers, and Maplewood Kiwanis Club.

Leather has "travel endurance"

When you see a piece of "globe-trotting" luggage, you're looking at leather that's been around. It has taken a long-term beating but is still doing a good job.



Modern leather belting used for power transmission has that same inherent wear-resistance. That's the reason why it is marking up records for long service traveling around the pulleys of modern industry.

A modern leather belt drive with a tension-control motor base . . . the last word in power transmission via leather.

AL-31

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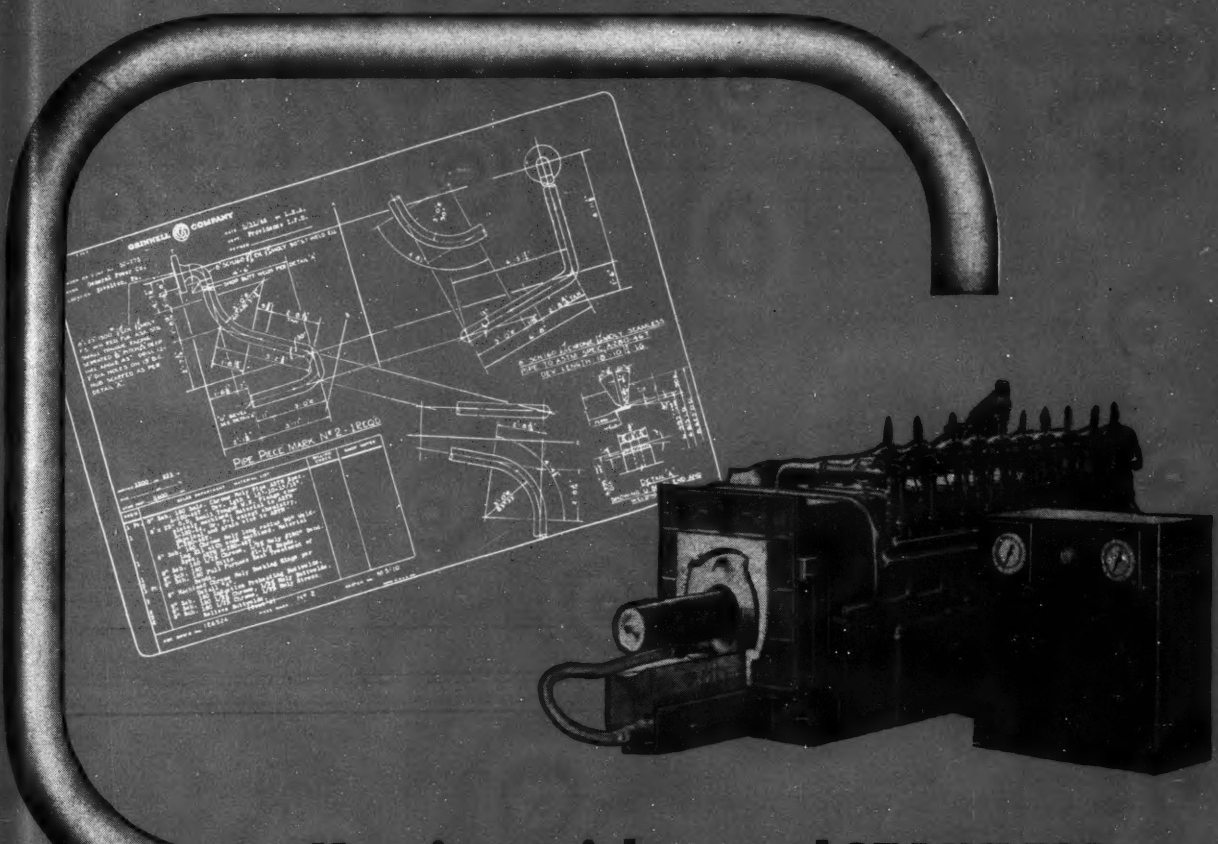

Keeping stainless steel STAINLESS

. . . a typical problem in fabricating alloy piping

Heat a piece of stainless steel pipe to bend it and right away you're up to your ears in metallurgical complications. To begin with, stainless steel isn't just one alloy. There are hundreds of different types of stainless steel, each selected for its resistance to corrosion or its stability at high temperatures. To maintain the metallurgical properties which dictate the choice of a particular alloy steel, you have to know the temperature range within which this steel may suffer excessive metallurgical changes. And you have to have specialized equipment to maintain the precise control necessary to avoid these hazards.

Grinnell pipe fabrication equipment includes specially designed gas-fired radiant heat furnaces for this precisely controlled heat treatment of stainless steels and other alloy steels. Multiple burners are strategically located to distribute temperature uniformly and to prevent harmful flame impingement. Precision instruments regulate temperature and time.

It's an intricate business . . . fabricating alloy steel piping. It's a job for Grinnell prefabricating plants because Grinnell has the equipment and modern methods, the interpretive engineering, the metallurgical research facilities and the skilled personnel.

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ENGINEERING GRADUATES HAVE FOUND ATTRACTIVE OPPORTUNITIES WITH GRINNELL.

STRESS and STRAIN...

Working in a tin can factory a man caught his coat in a revolving wheel, and was whisked up and hurled round and round until the foreman managed to turn off the machine.

Up rushed the foreman. "Speak to me. Speak to me," he pleaded.

The victim looked up. "Why should I?" he said, "I passed you six times, and you didn't speak to me."

* * *

Marriage is like a cafeteria—grab something good looking and pay later.

* * *

A colored preacher walked into a saloon, ordered milk, and by mistake was served milk punch.

After drinking it, the holy man lifted his eyes to heaven and was heard to say, "Oh, Lawd, what a cow!"

* * *

"So you've been to college, eh?"

"Yeah."

"How high can you count?"

"One, two, three, four, five, six, seven, eight, nine, ten, jack, queen, king, ace."

* * *

Three gentlemen appeared at the railroad station, alcoholically propelled. As they reached the platform, the train began to move, and all three staggered for it. The station cop and a porter managed to bundle two of them aboard, but by this time the train was going too fast for the third gent. He stood sadly on the platform watching it disappear.

"Too bad, mister," the cop said. "Wish you could have gotten aboard."

"Yes," replied the man, "and my frens'll be sorry too. They were seeing me off."

A contractor walked past the psychiatric ward of an asylum each morning on his way to the office and watched one of the inmates go through the motions of winding up and pitching an imaginary ball. One of his friends finally asked him why he stopped daily and watched the screwball go through his act.

"Well," he answered, "If things keep going the way they are on this present job, I'll soon be in there catching for that guy, and I want to get on to his curves."

* * *

"Give me a cigarette, Joe."

"I thought you had quit smoking."

"Well, I got to the first stage; I've quit buying."

* * *

When a pretty girl got on the crowded bus, a pale-looking fellow started to get up. But she pushed him back in the seat, and said she preferred to stand. Again he tried to get up and again she pushed him back. Finally he yelled, "Now, listen, lady! I passed my stop two blocks back — let me out!"

One termite said to the other termite when he saw a venetian blind, "Look, our bread comes sliced now."

* * *

Recently a would-be chicken fancier had some difficulty with her flock and wrote the following letter to the Cornell Department of Agriculture:

"Something is wrong with my chickens. Every morning when I come out I find two or three lying on the ground, cold and stiff, with their feet in the air. Can you tell me what is the matter?"

After a little while she received the following letter from the Department:

"Dear Madam: Your chickens are dead."

* * *

The girl on the bus was reading about birth and death statistics. Suddenly she turned to a male beside her and said, "Do you know that every time I breathe a man dies?"

"Very interesting," he returned, "why don't you try Sen-Sen?"

"Something about a right-hand rule . . . "

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